TM 11-6660-263-24-4

TECHNICAL MANUAL

ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL FOR

METEOROLOGICAL DATA PROCESSING GROUPS OL-192/GMD-1 (NSN 6660-01-065-4467) AND OL-192A/GMD-1 (NSN 6660-01-065-4466) CABLE ASSEMBLY, SPECIAL PURPOSE CX-13096/U (HP 98032A 16-BIT INTERFACE)

HEADQUARTERS, DEPARTMENT OF THE ARMY
17 APRIL 1980

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DEPARTMENT OF THE ARMY
WASHINGTON, DC, *17 April 1980*

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703.

In either case a reply will be furnished direct to you.

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CHAPTER 0

INTRODUCTION

0-1. Scope

a. This manual in conjunction with TM 11-6660-263-24-1, TM 11-6660-263-24-2, and TM 11-6660-263-24-3 comprise the organizational, direct support, and general support maintenance manuals for Meteorological Data Processing Groups OL-192/GMD-1 and OL-192A/GMD-1. Refer to Appendix D for titles of manuals and equipments covered.

b. Cable Assembly, Special Purpose CX-13096/U is the nomenclature assigned to Hewlett-Packard 98032A 16-Bit Interface.

c. The Repair Parts and Special Tools Lists (RPSTL) are included in TM 11-6660-263-20P and TM 11-6660-263-34P.

0-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

0-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

0-4. Reporting Equipment Improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703. We'll send you a reply.

0-5. Administrative Storage

Refer to TM 11-6660-263-10, Chapter 1, for administrative storage.

0-6. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

Chapter 1
General Information

Introduction

The HP 98032A I/O Interface is a general-purpose interface which provides 16-bit data exchange between the HP 9825A Calculator and a peripheral device. The interface transfers data in a "full-duplex" mode. That is, it can have data on the output lines and be inputing data at the same time.

The hardware and software characteristics of the interface are extremely flexible. The data exchange timing and logic can be "configured", by the use of jumpers, to meet a wide variety of peripheral requirements.

The interface is shipped from the factory either as an Option or Standard Interface. The Option Interface is pre-configured for operation with a given calculator peripheral. The Standard Interface is to be configured by you, to meet your peripheral's requirements.

Technical Specifications

Data Input Lines:	16 latched, DI0 – DI15
Data Output Lines:	16 open collector, DO0 – DO15
Control Lines:	PCTL, PFLG
Signal Levels:	TTL and open collector
Temperature Range:	0 ° to 45 °C Ambient
Power:	+5 Volts 300ma, obtained from the Calculator
Dimensions:	Approximately 16.3 × 8.9 × 3.8 cm (6.4 × 3.5 × 1.5 in)
Cable Length:	Standard – 4.5m (15′) Options – 2.0m (6.5′)

Available Options

The presently available options listed in Table 1-1, are shipped from the factory with the proper configuration jumpers and cable connector installed, as required by the listed calculator peripheral. This will allow you to connect your peripheral to the calculator without having to configure the interface. A wiring-diagram of the added connector and a diagram of the configuration jumpers are furnished with each Option Interface.

Table 1-1. Interface Options

Interface Option	Peripheral	Factory Select Code* Setting
Option 062	9862A Plotter	5
Option 063	9863A Paper Tape Reader	3
Option 064	9864A Digitizer	4
Option 066	9866A/B Thermal Page Printer	6
Option 069	9869A Hopper Card Reader	3
Option 071	9871A Impact Line Printer	6
Option 083	9883A Paper Tape Photo Reader	3
Option 084	9884A Paper Tape Punch	2

*See Select Code in Chapter 2.

Hardware Description

The Standard Interface consists of three circuit boards in a case. The case plugs into any one of the calculator I/O slots. A 4.5 meter (15 feet) unterminated shielded-cable is provided for connection to your peripheral.

The logic lines available to the user are:

- Sixteen latched data input lines.
- Sixteen latched data output lines.
- Three handshake lines.
- Two peripheral control lines.
- Three peripheral status lines.
- One line for DMA (Direct Memory Access) interrupt request.
- One line to reset the peripheral.
- Shield and ground connections.

Chapter 2
Installation Considerations

Introduction

The complexity of the installation procedure depends on the device to be interfaced to the calculator. If the device is one of the calculator peripherals listed in Table 1-1, and you have the correct Option Interface, the procedure is quite simple. But if the device is one of your own, you will have to "configure" the Standard Interface to meet your needs. This involves installing the correct jumpers on the Configuration Board (see Figure 2-3) and installing a connector on the end of the cable.

Select Code

The select code should be checked for the proper setting as required by your system. The select code switch is accessible through a hole in the top of the interface case. If the interface is one of the options, the select code will be preset to the standard select code for the associated peripheral. The Standard Interface will be preset to select code 2. If it is necessary to change the setting, rotate the switch to the desired position using a small screwdriver. You should avoid using select codes reserved for the peripherals internal to the calculator. For example, the select codes shown below are used by the 9825A internal peripherals.

Select Code	9825A Calculator Internal Peripheral
0	Keyboard/Display
1	Cartridge
16	Printer

Two interfaces should not be set to the same select code.

Select Code Interrupt Considerations*

In the interrupt mode, the 98032A operates on one of two priority levels. Interfaces set to Select codes 0 through 7 are on the low priority interrupt level and select codes 8 through 15 are on the high priority level. Devices requiring fast interrupt service should be set to the high level. Priority within a level is in order of the select code, with 7 and 15 having the highest priority.

Checking Interface Operations

When an interface is installed it should be checked for proper operation. To do this, read the status from the appropriate select code. For correctly installed interfaces, the returned value will be equal to or greater than 288. If the interface is not inserted correctly or if the select code setting is incorrect a zero will be returned.

Option Interface Installation

Each Option Interface is shipped from the factory with the proper configuration jumpers and cable connector for a given calculator peripheral (see Table 1-1). To connect one of the listed peripherals to the calculator follow the instructions supplied with the peripheral. Those instructions describe how to check the interface select code and make the necessary cable connections.

Standard Interface Installation

To install the Standard Interface with any other peripheral device it will be necessary to configure the interface to meet your needs. Configuring the interface is done by installing (soldering) the proper jumpers and if necessary a timing capacitor onto the Configuration Board (A-2). An appropriate cable connector should also be installed on the end of the cable.

In some cases, even though the configuration of the interface is very flexible, you may need to alter, or add to, the I/O logic of your device in order to make it compatible with the calculator I/O system.

*An I/O ROM with interrupt capability is required to use the interrupt mode.

Basic Installation Steps

The following basic installation steps are given, to aid you in connecting your peripheral to the calculator via the Standard 98032A Interface. The information necessary to implement these steps follows in the next sections of this chapter.

1. Determine the type of handshake that your peripheral will require.
2. Select, if necessary, a timing capacitor.
3. Determine the logic lines that are to be used by your peripheral.
4. Install the proper configuration jumpers to obtain the proper logic (positive or negative true) and I/O handshake.
5. Connect the cable to your device or install the proper cable connector on the cable.
6. Set the select code switch to the proper position.
7. Connect the system together and check from the calculator keyboard all intended I/O operations (refer to Checking Interface Operations).
8. If there is a failure in step 7, install the optional test connector (refer to Interface Operational Test) and check similar I/O operations. If this fails refer to the Service section of this manual. If the I/O operations on the test connector operate properly, the problem is probably in the cable wiring, choice of jumpers, or your peripheral.

Data Handshake

Synchronization of data exchanged between the calculator and a peripheral is referred to as the "handshake". The handshake is accomplished via the PCTL, PFLG and I/O lines. The peripheral receives information about the data exchange on the PCTL and I/O lines and then responds on the PFLG line. The I/O line tell the peripheral which direction the data is to be transferred, low indicates a calculator output operation, high indicates a calculator input operation.

If your peripheral does not require a handshake, connect the PFLG line to the PCTL line and then isolate these wires. Install either jumper 3 or jumper 4, but NOT both. Refer to Configuring the Logic (page 12) and to Figure 2-3.

The handshake lines, their states and intended meanings are listed in Table 2-1.

Table 2-1. Handshake Lines

LINE	STATE OR MNEMONIC	MEANING
Output		
I/O	LOW	Calculator output operation.
PCTL (From Interface)	CONTROL CLEAR	No new output data available.
	CONTROL SET	New output data is available on output line.
PFLG (From Peripheral)	READY	Peripheral is ready for next data transfer.
	BUSY	Peripheral is not ready for next data transfer.
Input		
I/O	HIGH	Calculator input operation.
PCTL (From Interface)	CONTROL CLEAR	Calculator is not requesting new data.
	CONTROL SET	Calculator is requesting new data.
PFLG (From Peripheral)	READY	Peripheral is ready for next transfer.
	BUSY	Peripheral is not ready for next transfer.

The reason that the state of the PCTL and PFLG lines are not referred to as being either "high" or "low" is that the logic level of these lines can be complemented by installing jumpers on the Configuration Board. The use of mnemonics for the state of these lines allows discussion of the handshake logic without refering to the specific jumper configuration chosen for your peripheral.

The Two Modes of Handshake

The two modes of handshake are referred to as "full" and "pulse". The pulse mode is selected by installing jumper 6 on the configuration board. Without jumper 6 the full mode is selected.

In the full mode, which can be considered the normal mode, the calculator will check the PFLG line (from the peripheral) to ensure that it is at the ready state before setting PCTL (control set) to initiate another data transfer.

In the pulse mode of handshake the calculator will not check the state of the PFLG line before setting the PCTL line to control set (refer to Figure 2-2). Applications which require this mode do not have true ready/busy levels on their PFLG line. Only a transition on the PFLG line is used to terminate the transfer.

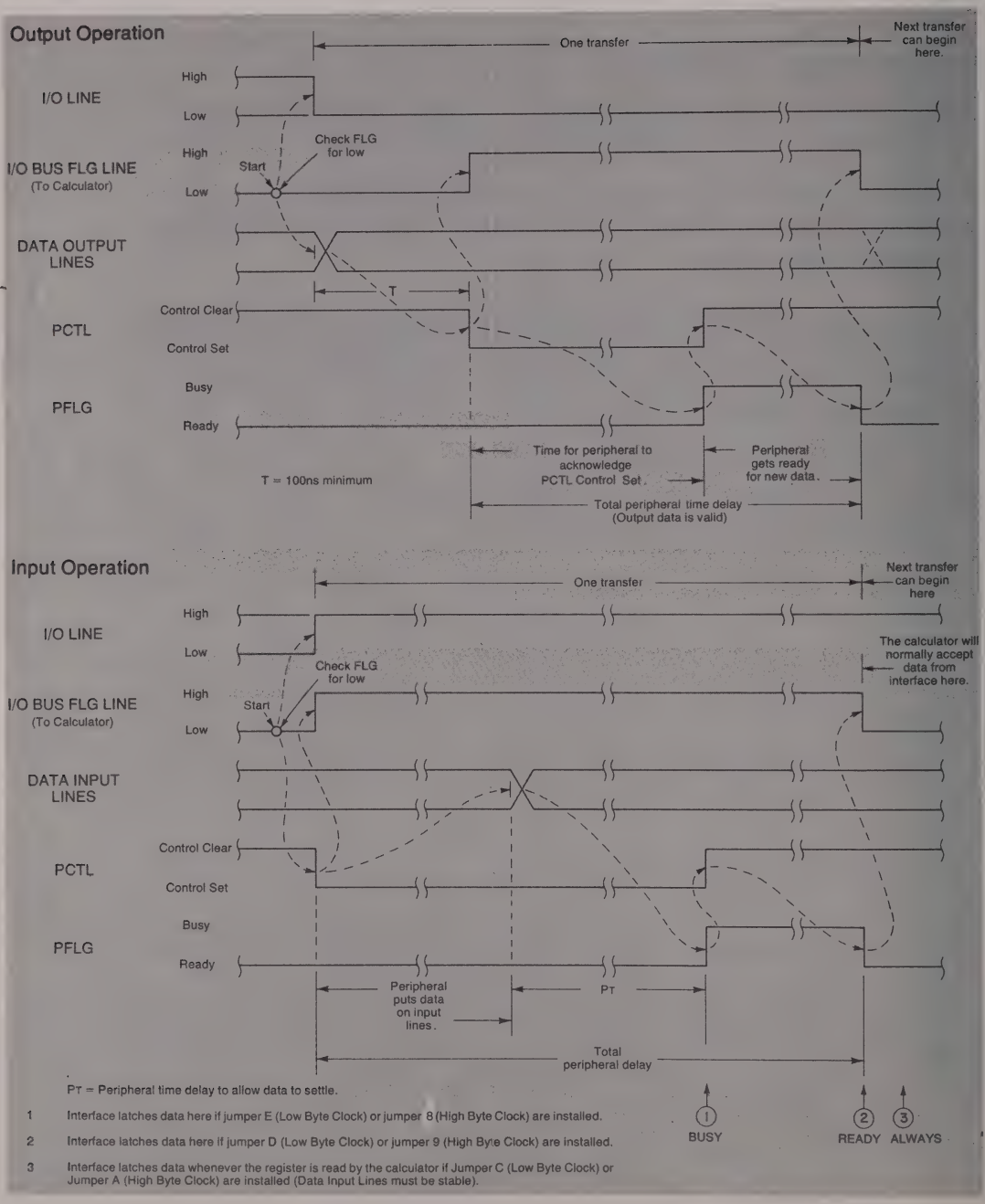

Output Operation
One transfer
Next transfer can begin here.
I/O LINE
High
Low
I/O BUS FLG LINE
(To Calculator)
Check FLG for low
Start
DATA OUTPUT LINES
T
PCTL
Control Clear
Control Set
PFLG
Busy
Ready
T = 100ns minimum
Time for peripheral to acknowledge PCTL Control Set.
Peripheral gets ready for new data.
Total peripheral time delay (Output data is valid)
Input Operation
One transfer
Next transfer can begin here
The calculator will normally accept data from interface here.
DATA INPUT LINES
Peripheral puts data on input lines.
PT
Total peripheral delay
PT = Peripheral time delay to allow data to settle.
1 Interface latches data here if jumper E (Low Byte Clock) or jumper 8 (High Byte Clock) are installed.
2 Interface latches data here if jumper D (Low Byte Clock) or jumper 9 (High Byte Clock) are installed.
3 Interface latches data whenever the register is read by the calculator if Jumper C (Low Byte Clock) or Jumper A (High Byte Clock) are installed (Data Input Lines must be stable).
1 BUSY
2 READY
3 ALWAYS

Figure 2-1. Full Mode Timing Diagram
(Jumper 6 Omitted)

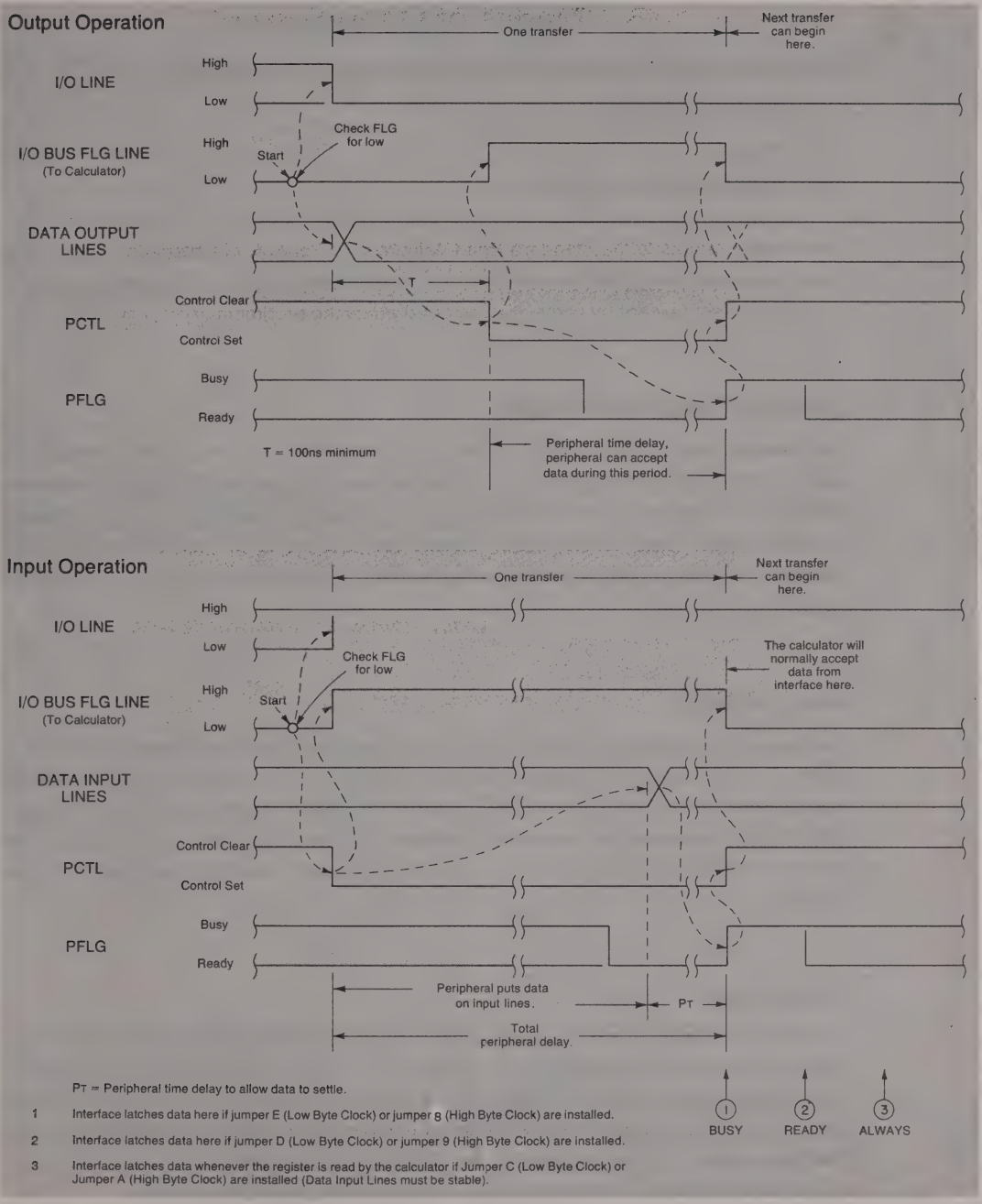

Output Operation
One transfer
Next transfer can begin here.
I/O LINE
High
Low
I/O BUS FLG LINE
(To Calculator)
Check FLG for low
Start
DATA OUTPUT LINES
T
PCTL
Control Clear
Control Set
PFLG
Busy
Ready
T = 100ns minimum
Peripheral time delay, peripheral can accept data during this period.
Input Operation
One transfer
Next transfer can begin here.
The calculator will normally accept data from interface here.
DATA INPUT LINES
Peripheral puts data on input lines.
PT
Total peripheral delay.
PT = Peripheral time delay to allow data to settle.
1 Interface latches data here if jumper E (Low Byte Clock) or jumper 8 (High Byte Clock) are installed.
2 Interface latches data here if jumper D (Low Byte Clock) or jumper 9 (High Byte Clock) are installed.
3 Interface latches data whenever the register is read by the calculator if Jumper C (Low Byte Clock) or Jumper A (High Byte Clock) are installed (Data Input Lines must be stable).
1 BUSY
2 READY
3 ALWAYS

Figure 2-2. Pulse Mode Timing Diagram
(Jumper 6 Installed)

Modes of Operation

The interface has three programmable modes of operation. The modes are:

1. Standard Read/Write
2. Interrupt
3. DMA (Direct Memory Access)

The interface returns to the Standard Read/Write mode whenever the interface is reset. The modes are transparent to the peripheral, that is the peripheral does not know which mode is currently in effect (except by convention established by the programmer).

Standard Read/Write Mode

The Standard Read/Write mode becomes active when the DMA and Interrupt modes are disabled (bits 6 and 7 of register 5 = 0). The calculator checks the I/O Bus FLG line before initiating a transfer, the calculator will wait if the FLG line is not low (Ready). A handshake is initiated for each data transfer, which causes the FLG line to go high (Busy). When the peripheral completes the handshake, using the PFLG line, the calculator can start another transfer.

Interrupt Mode

The Interrupt mode becomes active when the calculator sets the interrupt enable bit (bit 7 of register 5 = 1) and DMA is disabled (bit 6 of register 5 = 0). An interrupt request is made when the peripheral indicates on the PFLG line that it is ready for the next handshake. Program control will be transferred to the service routine for the peripheral. The service routine must either start another data transfer or it must disable the interrupt mode (to prevent repeating the interrupt).

DMA Mode

If jumper 7 is installed, the DMA mode becomes active when the calculator sets the DMA and Auto Handshake bits (bits 6 and 4 of register 5 = 1). The Interrupt mode will normally be enabled also. A DMA transfer is requested each time the peripheral indicates on the PFLG line that it is Ready for new data. The DMA transfer request will be repeated for each word of the DMA data block. After the last transfer, the DMA mode will be automatically disabled by the calculator and if the interrupt mode was enabled, an interrupt will be requested.

Selecting Timing Capacitor

The interface is shipped from the factory with a built-in 100 ns (minimum) output-time-delay. This delay is in the PCTL line. When the interface is used in a noisy electrical environment or when extra-long cables are used the output-time-delay should be increased to allow more time for the data to settle. Adding a capacitor to the configuration board (see Figure 2-3) will lengthen the output-time-delay. Typically a .002μf capacitor is installed, this will increase the output-time-delay to about 8μs (minimum). It may be much longer depending on the I/O statement which is used to do the data transfer.

The formula for the value of the capacitor needed for a required time delay is:

$$C \approx \frac{T-100}{4}$$

Where:

C = Capacitance (in pico-farads)
T = Total time delay required (in Nano-seconds)

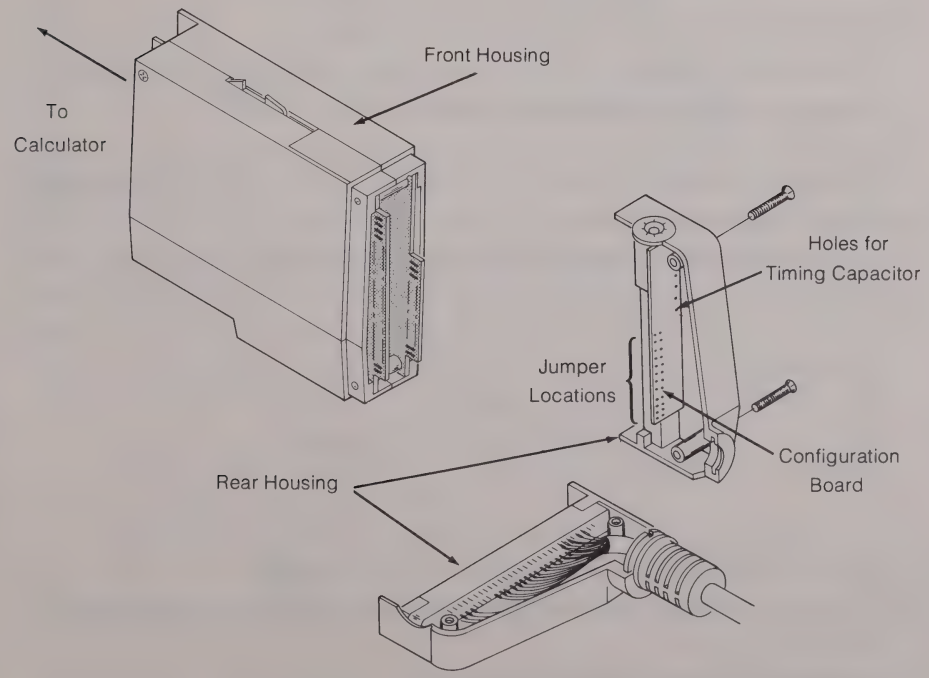


Figure 2-3. Configuration Board

Cable Preparation

Prepare the end of the interface cable as shown in Figure 2-11. Notice that the outer shield and bare wire are not connected to the peripheral.

> NOTE
>
> Improper operation will result, due to crosstalk, if the outer shield or outer bare wire is connected to the peripheral ground.

Use heatshrink tubing or tape to insulate the shields as shown in Figure 2-11.

Procedure

Refer to Figure 2-11.

1. Cut the cable to the required length, allow some length for slack.
2. Strip off the outer plastic jacket about 10 cm (4 inches).
3. Cut off the outer shield and outer bare wire to within 1 cm (½ inch) of outer jacket.
4. Carefully fold the outer shield back over jacket.
5. Cover the end of the jacket and outer shield with heatshrink tubing or tape.
6. Cut back the inner shield and its nylon jacket to within 2.5 cm (1 inch) of the outer jacket. DO NOT cut off inner bare wire.
7. Cover the end of the inner shield and nylon jacket with heatshrink tubing or tape.

> NOTE
>
> The inner and outer shields must not short together.

8. Strip and connect the cable wires as required by your peripheral.
9. Be sure to connect the logic ground wires (refer to Figure 2-11) to your peripheral's logic ground.
10. Isolate unused wire with heatshrink tubing or tape.

Recommended Driver Circuits

Data Lines

Each of the data-input lines on the interface are connected to input latches. A resistive divider is connected to each of the input lines, these dividers hold the voltage at about 3.4 volts when the cable is disconnected. The input voltage to these lines must not exceed 5.5 volts.

Here are typical specifications:

- I in low = 2 mA
- V in max = 5.5 V
- V in high > 2 V
- V in low < 0.7 V

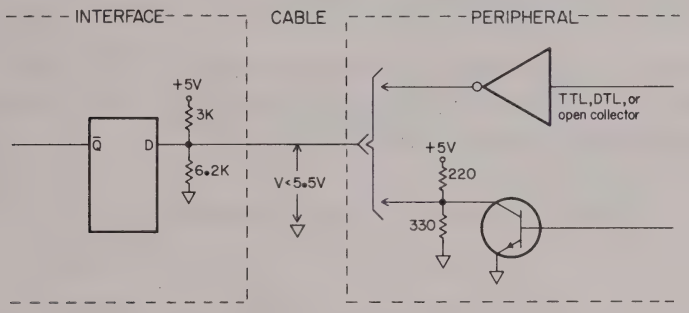


Figure 2-4. Recommended Peripheral Driver Circuit

Other Lines

The PFLG, PSTS, and EIR signals are received by Schmitt triggers circuits. These circuits accept signals with slow rise and fall times, and provide good noise margins. Although the voltage on these lines must not exceed 5.5 volts, there is no restriction on the input rise and fall time. Either of the driver circuits shown in Figure 2-4 may be used as drivers for these lines.

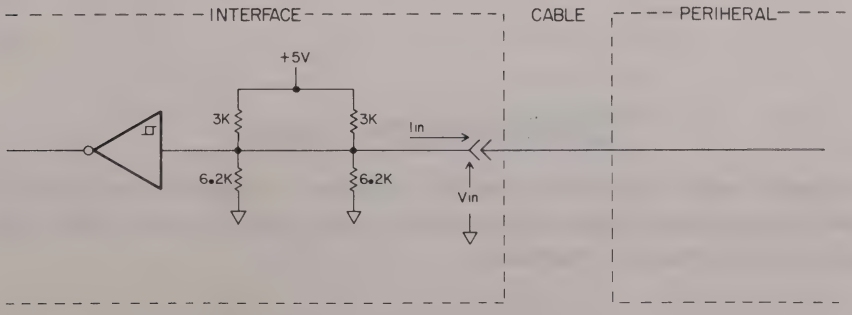


Figure 2-5. Interface PFLG, PSTS, and EIR Receiver Circuit

Recommended Receiver Circuits

Each output line from the interface is driven by an open-collector circuit. The current-sinking capability of each driver is 40 mA and the breakdown voltage is 30 volts. Do not apply a negative voltage to the output lines.

Here are typical specifications:

- V out low { at (I out low = 16 mA) = 0.4 V max.
  at (I out low = 40 mA) = 0.7 V max.
- V out high (open collector) = 30 V max.
- I out low = 40 mA max.
- I out high at (V out high max.) = 250 μA

Since each driver has an open collector, the peripheral receiving circuit must have a positive pull-up voltage (not to exceed 30 V) and must be restricted to sourcing less than 40 mA. Recommended receiving circuits are shown in Figure 2-6.

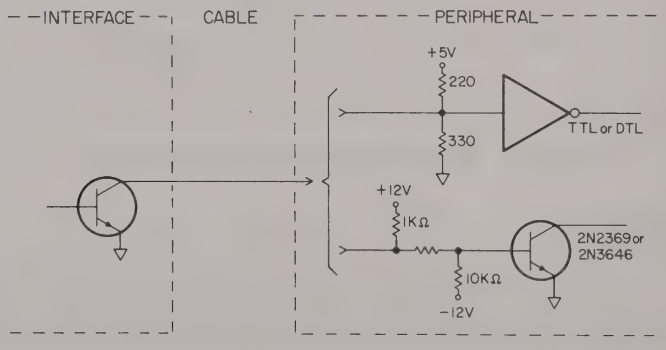


Figure 2-6. Recommended Peripheral Receiver Circuits

Configuring the Logic

The following sections describe the logic lines available to the user. A description of the function and associated configuration jumpers are given for each logic line. A jumper reference is provided at the end of this chapter.

Data Input Lines

16 Bits; DI0 through DI15; DI0 = LSB, DI15 = MSB

The 16 data input lines can be configured as two separate 8-bit bytes or one 16-bit word. In either case all data lines are latched by the input registers.

You can select the logic sense, positive or negative true, for the input data lines. The use of negative true logic is recommended for these lines. The inversion necessary, for the interface to operate on positive true logic, is done by the calculator.

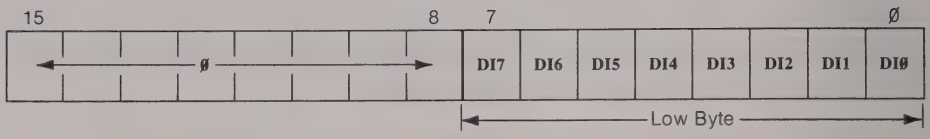
You have a choice of three clock sources that can be used for the data input latches. Refer to Data Handshake in this chapter.

Table 2-2. Data Input Lines

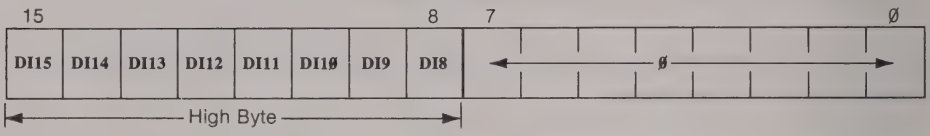
Mnemonic		Interface Connector Pin No.	Wire Color Code	
Low Byte	DI0	B-17	Black	(0)
	DI1	B-16	Brown	(1)
	DI2	B-15	Red	(2)
	DI3	B-14	Orange	(3)
	DI4	B-13	Yellow	(4)
	DI5	B-12	Green	(5)
	DI6	B-11	Blue	(6)
	DI7	B-10	Violet	(7)
High Byte	DI8	B-9	White/Brown/Red	(912)
	DI9	B-8	White/Brown/Orange	(913)
	DI10	B-7	White/Brown/Yellow	(914)
	DI11	B-6	White/Brown/Green	(915)
	DI12	B-5	White/Red/Orange	(923)
	DI13	B-4	White/Red/Yellow	(924)
	DI14	B-3	White/Red/Green	(925)
	DI15	B-2	White/Red/Blue	(926)

Byte Mode (Jumper B not installed)

Register 4



Register 6



Word Mode (Jumper B installed)

Registers 4 and 6

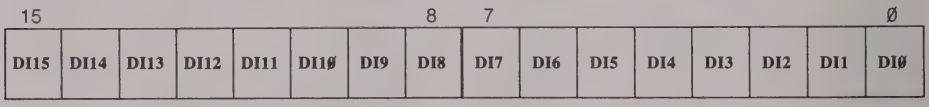


Figure 2-7. Data Input Bit Assignment

Associated Configuration Jumpers

Positive- or Negative-true Input Logic

- Jumper 1 – When installed, sets bit 3 in the status register to indicate to the calculator that the input data is to be complemented, bit for bit, before being used or stored. This changes the input lines to positive true logic (ground = logic zero).

Word or Byte Mode

- Jumper B – When installed, selects the word input mode.

Low Byte Clock – Install **Only One** of the three jumpers.

- Jumper D – Clocks the low byte input data when PFLG goes ready.
- Jumper E – Clocks the low byte input data when PFLG goes busy.
- Jumper C – Clocks the low byte input data at the time the calculator reads the register.

High Byte Clock – Install **Only One** of the three jumpers.

- Jumper 8 – Clocks the high byte input data when PFLG goes ready.
- Jumper 9 – Clocks the high byte input data when PFLG goes busy.
- Jumper A – Clocks the high byte input data at the time the calculator reads the register.

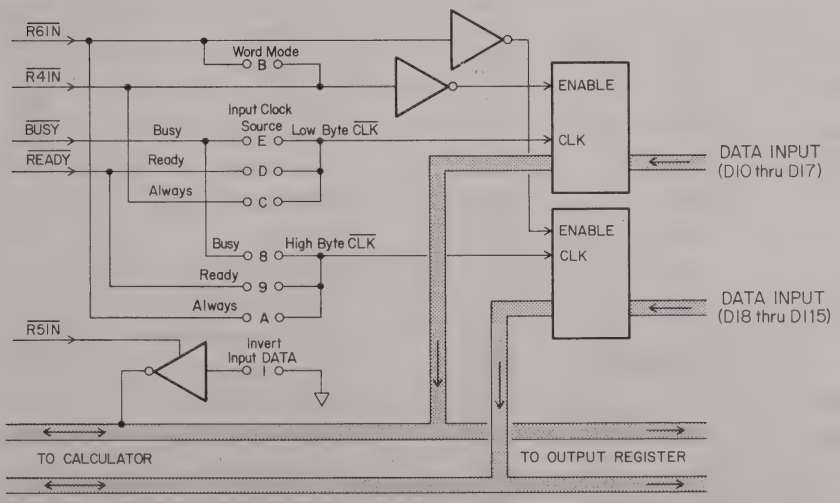


Figure 2-8. Data Input Clocks

Data Output Lines

16-Bits; DO0 through DO15; DO0 = LSB, DO15 = MSB

The 16 data output lines can be configured as two separate 8-bit bytes or one 16-bit word. In the byte mode only eight of the 16-bits sent to the interface from the calculator are latched. The other 8-bits on the output lines are not affected. The output bits are glitch free and always present at the output connector unless changed by the calculator. Unused lines can be left unconnected or grounded.

You can select the logic sense, positive or negative true, for the output data lines. The use of negative true logic is recommended for these lines. The inversion necessary, for the interface to operate on positive true logic, is done by the calculator.

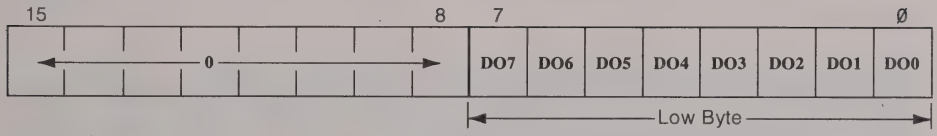
Normally the state of the output data lines is undetermined when the calculator is switched on. By installing jumper wire E1 and diode CR1 (refer to the schematic and component locator), all of the output data lines are preset to low each time the calculator is switched ON or when the RESET key is pressed.

Table 2-3. Data Output Lines

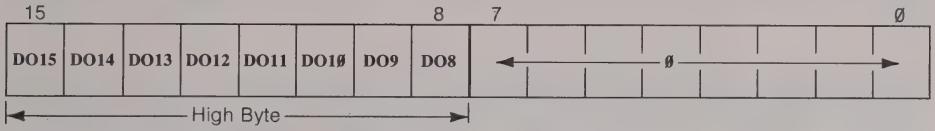
Mnemonic		Interface Connector Pin No.	Wire Color Code	
Low Byte	DO0	A-17	White/Black	(90)
	DO1	A-16	White/Brown	(91)
	DO2	A-15	White/Red	(92)
	DO3	A-14	White/Orange	(93)
	DO4	A-13	White/Yellow	(94)
	DO5	A-12	White/Green	(95)
	DO6	A-11	White/Blue	(96)
	DO7	A-10	White/Violet	(97)
High Byte	DO8	A-9	White/Orange/Yellow	(934)
	DO9	A-8	White/Orange/Green	(935)
	DO10	A-7	White/Orange/Blue	(936)
	DO11	A-6	White/Orange/Violet	(937)
	DO12	A-5	White/Yellow/Green	(945)
	DO13	A-4	White/Yellow/Blue	(946)
	DO14	A-3	White/Yellow/Violet	(947)
	DO15	A-2	White/Yellow/Gray	(948)

Byte Mode (Jumper F not installed)

Register 4



Register 6



Word Mode (Jumper F installed)

Register 4 and 6

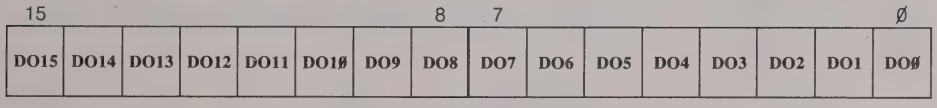


Figure 2-9. Data Output Bit Assignment

Associated Configuration Jumpers

Positive- or Negative-true Output Logic

- Jumper 2 – When installed, sets bit 2 in the status register to indicate to the calculator that the output data is to be complemented, bit for bit, before being sent to the interface. This changes the output lines to positive true logic (ground = logic zero).

Word or Byte Mode

- Jumper F – When installed, selects the word output mode.

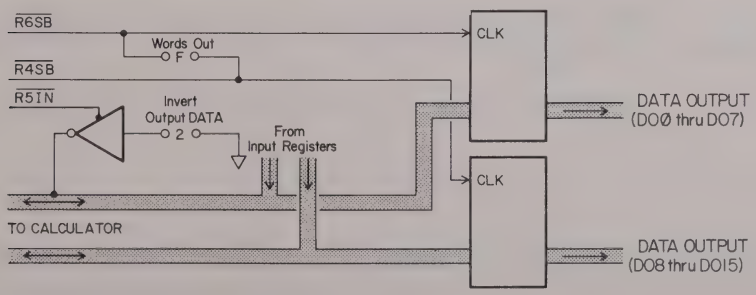


Figure 2-10. Data Output Strobe

Peripheral Control Line

1 Bit; PCTL

This line is paired with PFLG and is used to synchronize (handshake) the calculator and your peripheral. The two states of this line are control set and control clear. The peripheral clears control on the PCTL line by a ready-to-busy transition on the PFLG line (see Peripheral Flag Line).

PCTL is delayed to allow new output data to settle. This delay time is set to 100 ns minimum at the factory, but it may be changed to a larger value by adding a capacitor to the Configuration Board (see Selecting Timing Capacitor).

The logic sense of the PCTL line can be inverted by installing jumper 3 (control set = high; control clear = low).

Table 2-4. Peripheral Control Line

Mnemonic	Interface Connector Pin No.	Wire Color Code
PCTL	A-19	White/Gray (98)

Associated Configuration Jumper

Logic Sense

- Jumper 3 – When installed, complements the logical sense of PCTL (high = control set and low = control clear).

Peripheral Flag Line

1 Bit; PFLG

This line must be driven to complete a transfer. It is paired with PCTL and is used to synchronize (handshake) the calculator and your peripheral. If no handshake is required, then PFLG must be connected to PCTL at the peripheral end of the cable, and jumper 3 or 4 must be installed (not both).

One of two modes of handshake can be selected: by installing jumper 6 the pulse mode of handshake is selected; by omitting jumper 6 the full mode of handshake is selected. Refer to the "Data Handshake" section in this chapter.

The logic sense of the PFLG line can be inverted, by installing jumper 4 (busy = low; ready = high). This line is also used to request "interrupt." *

Table 2-5. Peripheral Flag Line

Mnemonic	Interface Connector Pin No.	Wire Color Code
PFLG	B-19	Gray (8)

Associated Configuration Jumpers

Logic Sense

- Jumper 4 – When installed, complements the logical sense of PFLG, (high = ready and low = busy).

Handshake Mode

- Jumper 6 – When installed, selects the pulse mode of handshake.

Allow DMA

- Jumper 7 – When installed, allows the interface to request DMA when the calculator activates the DMA mode of operation on the interface. Note that the interface must be set to words mode of operation (Jumper F installed for DMA output and Jumper B installed for DMA input).

Peripheral Status Line

1 Bit; PSTS

Use of the PSTS line is optional, but encouraged. Your peripheral should use this line to signal the calculator that all is "OK". When the peripheral is powered down, interlocks are broken, it is out of paper, etc., a "not OK" signal can be sent to the calculator on this line.

The logic sense of the PSTS line can be complemented by installing jumper 5, making low the OK state and high the not OK state. This allows you to detect an open cable, because when this line is open it will float high – not OK.

Table 2-6. Peripheral Status Line

Mnemonic	Interface Connector Pin No.	Wire Color Code	
PSTS	B-20	White/Black/Gray	(908)

Associated Configuration Jumper

Logic Sense

- Jumper 5 – When installed, complements the logic sense of PSTS (high = not OK and low = OK).

Extended Status Input Lines

2 Bits; STI0, STI1

Use of these two input lines is optional. They can be used for any purpose that reflects the status of the peripheral. The state of these lines can be examined by reading the status register.

Table 2-7. Extended Status Lines

Mnemonic	Interface Connector Pin No.	Wire Color Code	
STI0	B-22	White/Brown/Blue	(916)
STI1	B-23	White/Brown/Violet	(917)

Extended Control Output Lines

2 Bits; CTL0, CTL1

Use of these two output lines is optional. They can be used for any purpose to control the peripheral. These lines are latched and can be set or cleared (1 = low, 0 = high) by outputing to the control register. These lines are undetermined at power up.

Table 2-8. Extended Control Output Lines

Mnemonic	Interface Connector Pin No.	Wire Color Code	
CTL0	A-22	White/Red/Violet	(927)
CTL1	A-23	White/Red/Gray	(928)

Input/Output Direction Control Line

1 Bit; I/O

Use of this output line is optional. This line is always valid during PCTL control set and indicates to the peripheral which direction the data transfer is to go. This line is high for an input operation and low for an output operation.

Table 2-9. I/O Direction Control Lines

Mnemonic	Interface Connector Pin No.	Wire Color Code	
I/O	A-20	White/Black/Brown	(901)

Peripheral Reset Line

1 Bit; PRESET

Use of this line is optional. It can be used to initialize your peripheral. It is pulsed low when the calculator is switched ON and when the RESET key is pressed. It is also pulsed low when the reset bit is sent to the control register. The minimum Preset pulse width is 230 ns.

Table 2-10. Preset Line

Mnemonic	Interface Connector Pin No.	Wire Color Code
PRESET	A-21	White/Black/Red (902)

External Interrupt Request Line

1 Bit; EIR

During DMA (Direct Memory Access) the EIR line can be used to cause the calculator to interrupt or abort the DMA transfer before completion of the entire data block transfer. Normal interrupt operation uses the PFLG line to request interrupt service, not the EIR line.

Table 2-11. External Interrupt Request Line

Mnemonic	Interface Connector Pin No.	Wire Color Code
EIR	B-21	White/Brown/Gray (918)

Associated Configuration Jumper

Allow DMA

- Jumper 7 – When installed, allows the calculator to activate the DMA mode of operation on the interface.

Grounding

Connect the ground wires indicated in Figure 2-11 to the peripheral's logic ground. Notice that the outer shield and outer bare wire are cut off and not connected to the peripheral.

> **NOTE**
>
> If the outer shield or outer bare wire is connected to the peripheral's ground improper operation may result (due to ground loops) and radio frequence interferance (RFI) may be radiated.

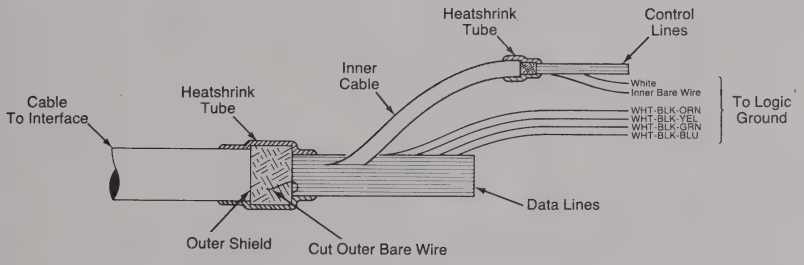


Figure 2-11. Cable Preparation and Ground Wires

Jumper Reference

Table 2-12. Configuration Jumpers

Jumper	Function, when installed
1	Sets bit 3 in the status register, changes the input data lines to positive true logic.
2	Sets bit 2 in the status register, changes the output data lines to positive true logic.
3	Complements the logic sense of PCTL; high = control set and low = control clear.
4	Complements the logic sense of PFLG; high = ready and low = busy.
5	Complements the logic sense of PSTS; high = not OK and low = OK.
6	Changes the handshake from full to pulse.
7	Allows the calculator to activate the DMA (Direct Memory Access) mode of operation.
* 8	Clocks the high input byte when PFLG goes busy from ready.
* 9	Clocks the high input byte when PFLG goes ready from busy.
* A	Clocks the high input byte at the time the calculator reads the register.
B	Selects the words input mode.
* C	Clocks the low input byte at the time the calculator reads the register.
* D	Clocks the low input byte when PFLG goes ready from busy.
* E	Clocks the low input byte when PFLG goes busy from ready.
F	Selects the words output mode.

*Select only one of these three.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *7 April, 1982*

Organizational, Direct Support, and General Support Maintenance Manual METEOROLOGICAL DATA PROCESSING GROUPS OL-192/GMD-1 (NSN 6660-01-065-4467) AND OL-192A/GMD-1 (NSN 6660-01-065-4466) CABLE ASSEMBLY, SPECIAL PURPOSE CX-13096/U (HP 98032A 16-BIT INTERFACE)

TM 11-6660-263-24-4, 17 April 1980, is changed as follows:

1. New or changed material is indicated by a vertical bar in the margin of the page.
2. Remove old pages and insert new pages as indicated below:

Remove	*Insert*
i and ii	i
0-1	0-1
D-1	D-1
E-1 and E-2	E-1 and E-2

3. File this change sheet in front of the publication for references purposes.

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Chief of Staff

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TM 11-6660-263-24-4

TECHNICAL MANUAL
No. 11-6660-263-24-4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *17 April 1980*

ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

METHEOROLOGICAL DATA PROCESSING GROUPS OL-192/GMD-1 (NSN 6660-01-065-4467) AND OL-192A/GMD-1 (NSN 6660-01-065-4466) CABLE ASSEMBLY, SPECIAL PURPOSE CX-13096/U (HP 98032A 16-BIT INTERFACE)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

In either case a reply will be furnished direct to you.

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CHAPTER O

INTRODUCTION

0-1. Scope

a. This manual in conjunction with TM 11-660-263-24-1, TM 11-6660-263-24-2, and TM 11-6660-263-24-3 comprise the organizational, direct support, and general support maintenance manuals for Meteorological Data Processing Groups OL-192/GMD-1 and OL-192A/GMD-1. Refer to Appendix D for titles of manuals and equipments covered.

b. Cable Assembly, Special Purpose CX-13096/U is the nomenclature assigned to Hewlett-Packard 98032A 16-Bit Interface.

c. The Repair Parts and Special Tools Lists (RPSTL) are included in TM 11-6660-263-20P and TM 11-6660-263-34P.

0-2. Index of Technical Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

0-3. Maintenance Forms, Records and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management Systems (Army).

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Reporting of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO 4610.19C/DLAR 4500.15.

0-4. Reporting Equipment Improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. We'll send you a reply.

0-5. Administrative Storage

Refer to TM 11-6660-263-10, Chapter 1, for administrative storage.

0-6. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

APPENDIX D

REFERENCES

Following is a list of publications which are applicable and available to the technician of the Meteorological Data Processing Groups OL-192/GMD-1 and OL-192A/GMD-1.

DA Pam 310-4	Index of Technical Publications.
TM 11-6660-263-10	Operator's Manual: Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 11-6660-263-20P	Organizational Maintenance Repair Parts and Special Tools Lists for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 11-6660-263-24-1	Organizational, Direct Support, and General Support Maintenance Manual for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 11-6660-263-24-2	Organizational, Direct Support, and General Support Maintenance Manual: Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466) Calculator, Programmable CP-1387/U (7420-01-026-2686) (HP 9825A Desktop Computer).
TM 11-6660-263-24-3	Organizational, Direct Support, and General Support Maintenance Manual: Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466), Reader-Perforator RP-263/GMD-1 (NSN 6660-01-068-8642) (Remex Model RAB 612XBA).
TM 11-6660-263-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX E

CX-13096/U WIRE RUN LIST
(98032A Opt A03)
(98032 Connector)

OUTPUT SIG	*WIRE CODE*	*PIN A*	*PIN B*	*WIRE CODE*	*INPUT SIG*
GND	Wh-Bk-Gn	1	1	Wh-Bk-Bu	GND
$\overline{\text{DO15}}$		2	2		$\overline{\text{DI15}}$
$\overline{\text{DO14}}$		3	3		$\overline{\text{DI14}}$
$\overline{\text{DO13}}$		4	4		$\overline{\text{DI13}}$
$\overline{\text{DO12}}$		5	5		$\overline{\text{DI12}}$
$\overline{\text{DO11}}$		6	6		$\overline{\text{DI11}}$
$\overline{\text{DO10}}$		7	7		$\overline{\text{DI1Ø}}$
$\overline{\text{DOØ9}}$		8	8		$\overline{\text{DIØ9}}$
$\overline{\text{DOØ8}}$		9	9		$\overline{\text{DIØ8}}$
$\overline{\text{DOØ7}}$	Wh-Vio	10	10	Vio	$\overline{\text{DIØ7}}$
$\overline{\text{DOØ6}}$	Wh-Bu	11	11	Blu	$\overline{\text{DIØ6}}$
$\overline{\text{DOØ5}}$	Wh-Gn	12	12	Grn	$\overline{\text{DIØ5}}$
$\overline{\text{DOØ4}}$	Wh-Y1	13	13	Yel	$\overline{\text{DIØ4}}$
$\overline{\text{DOØ3}}$	Wh-Gr	14	14	Org	$\overline{\text{DIØ3}}$
$\overline{\text{DOØ2}}$	Wh-Rd	15	15	Red	$\overline{\text{DIØ2}}$
$\overline{\text{DOØ1}}$	Wh-Bn	16	16	Brn	$\overline{\text{DIØ1}}$
$\overline{\text{DOØØ}}$	Wh-Bk	17	17	Blk	$\overline{\text{DIØØ}}$
GND	Wh	18	18	Drain (Inner bare)	
$\overline{\text{PCTL}}$	Wh-Gy	19	19	Gy	$\overline{\text{PFLG}}$
I/O		20	20	Wh-Bk-Gy	$\overline{\text{PSTS}}$
PRESET		21	21		$\overline{\text{EIR}}$
CTLO	Wh-Rd-Vio	22	22	Wh-Bn-Bu	$\overline{\text{STIØ}}$
CTL1	Wh-Rd-Gy	23	23	Wh-Vn-Vio	$\overline{\text{STI1}}$
GND	Wh-Bk-Or	24	24	Wh-Bl-Yel	GND
CHASSIS		25	25		CHASSIS

WIRE RUN LIST REMEX PLUGS FROM 98032

	DB-25S (TO J2)		*DB-25P (TO J1)*	
Pin No.	*Wire Code*	*Signal*	*Wire Code*	*Signal*
1	Blk	$\overline{\text{DI}\emptyset\emptyset}$	Wht-Bk	$\overline{\text{DO}\emptyset\emptyset}$
2	Brn	$\overline{\text{DI}\emptyset 1}$	Wht-Brn	$\overline{\text{DO}\emptyset 1}$
3	Red	$\overline{\text{DI}\emptyset 2}$	Wht-Red	$\overline{\text{DO}\emptyset 2}$
4	Orn	$\overline{\text{DI}\emptyset 3}$	Wht-Orn	$\overline{\text{DO}\emptyset 3}$
5	Yel	$\overline{\text{DI}\emptyset 4}$	Wht-Yel	$\overline{\text{DO}\emptyset 4}$
6	Grn	$\overline{\text{DI}\emptyset 5}$	Wht-Grn	$\overline{\text{DO}\emptyset 5}$
7	Blu	$\overline{\text{DI}\emptyset 6}$	Wht-Blu	$\overline{\text{DO}\emptyset 6}$
8	Vio	$\overline{\text{DI}\emptyset 7}$	Wht-Vio	$\overline{\text{DO}\emptyset 7}$
9	Wht-Yel-Blu	PFLG		
10				
11			Wht-Gra *Wht-Orn-Yel	$\overline{\text{PCTL}}$
12			Gra *Wht-Yel-Blu	$\overline{\text{PFLG}}$
13	Drain (Inner) Wht-Blk-Yel Wht-Blk-Blu *Wht-Yel-Grn	 GND GND	Wht-Blk-Grn	$\overline{\text{PSTS}}$
14	Wht-Brn-Vio	$\overline{\text{STI1}}$	Wht *Jumpers	GND
15	Wht-Red-Grn	$\overline{\text{CTL1}}$	*Jumpers-2	GND
16	*Wht-Orn-Yel	$\overline{\text{PCTL}}$		
17				
18			Wht-Blk-Orn Wht-Blk-Grn *Jumper	GND GND
19			Wht-Red-Vio	$\overline{\text{CTLO}}$
20			Wht-Brn-Blu	$\overline{\text{STI}\emptyset}$
21				
22				
23			*Wht-Yel-Grn	GND
24				
25				

*Marks added wires. Jumpers connect pins 14, 15, and 18 on DB-25P.

U.S. GOVERNMENT PRINTING OFFICE: 1982—564-016/222

*AM33AK
RN
Aug 87

METEOROLOGICAL DATA PROCESSING GROUP OL-192/GMD-1

REFERENCE NOTE

US ARMY
FIELD ARTILLERY SCHOOL
Target Acquisition Department
Fort Sill, Oklahoma

*Supersedes RN AM33AK, Aug 85.

INTRODUCTION

The purpose of the METEOROLOGICAL DATA PROCESSING GROUP OL-192/GMD-1 is to convert raw met data into accurate real time met messages. Even though most of the computations are automatic, the computer operator retains full control of the OL-192. He must enter the raw met data from the RADIOSONDE RECORDER AN/TMQ-5, and the raw wind data from the control-recorder when prompted by the LED display of the OL-192. Learning this procedure is the first step in becoming qualified to operate the OL-192. This procedure will be covered in Section I. In Section II you will be trained to enter raw met and wind data into the computer to produce the various met messages.

Section I. COMPONENTS AND ASSEMBLY

1. The OL-192 is designed to improve the operational capabilities do the technically obsolete RAWINSONDE SYSTEM by providing more timely met data which, in turn, increases the accuracy of artillery fire. The OL-192 is designed for operation within a mobile ground shelter or for transportation in airborne/air dropped open bed vehicles.

2. The OL-192 (fig 1) consists of a desk top mini computer, a paper tape reader/perforator and associated components. The computer, HP 9825A (fig 2), is a programmable desk top computer weighing 26 pounds which, when programed with a met program, will convert the raw met and wind data into usable met messages. It can be operated on any of four line voltages; 100, 120, 220, or 240 volts AC, with a line frequency from 48 to 66 Hertz. The tape reader/perforator (fig. 3) weighs 46 1/2 pounds and operates on 115, 220, or 240 volts AC with a line frequency from 47 to 64 Hertz.

3. The computer has a 32 character LED (light emitting diodes) display; a 16 character thermal printer which prints a hard copy tape listing of programs, entries, messages, and processed data on heat sensitive paper; a magnetic tape data cartridge reader which is used for fast loading and access of programs and /or data. The computer also has an audio alarm which prompts the operator to input data.

4. The most noticeable parts of the computer are the three keyboards. You, as operators, will be concerned primarily with the numeric keyboard and the special function keyboard. The computer is provided with a protective cover which encloses the alphanumeric keyboard and the special programming keys. This is to prevent the operator from accidentally using the wrong keys and destroying the met program when entering the raw met and wind data. Although the alphanumeric keyboard is covered, there are some instances when you will be required to use it. This procedure will be discussed later.

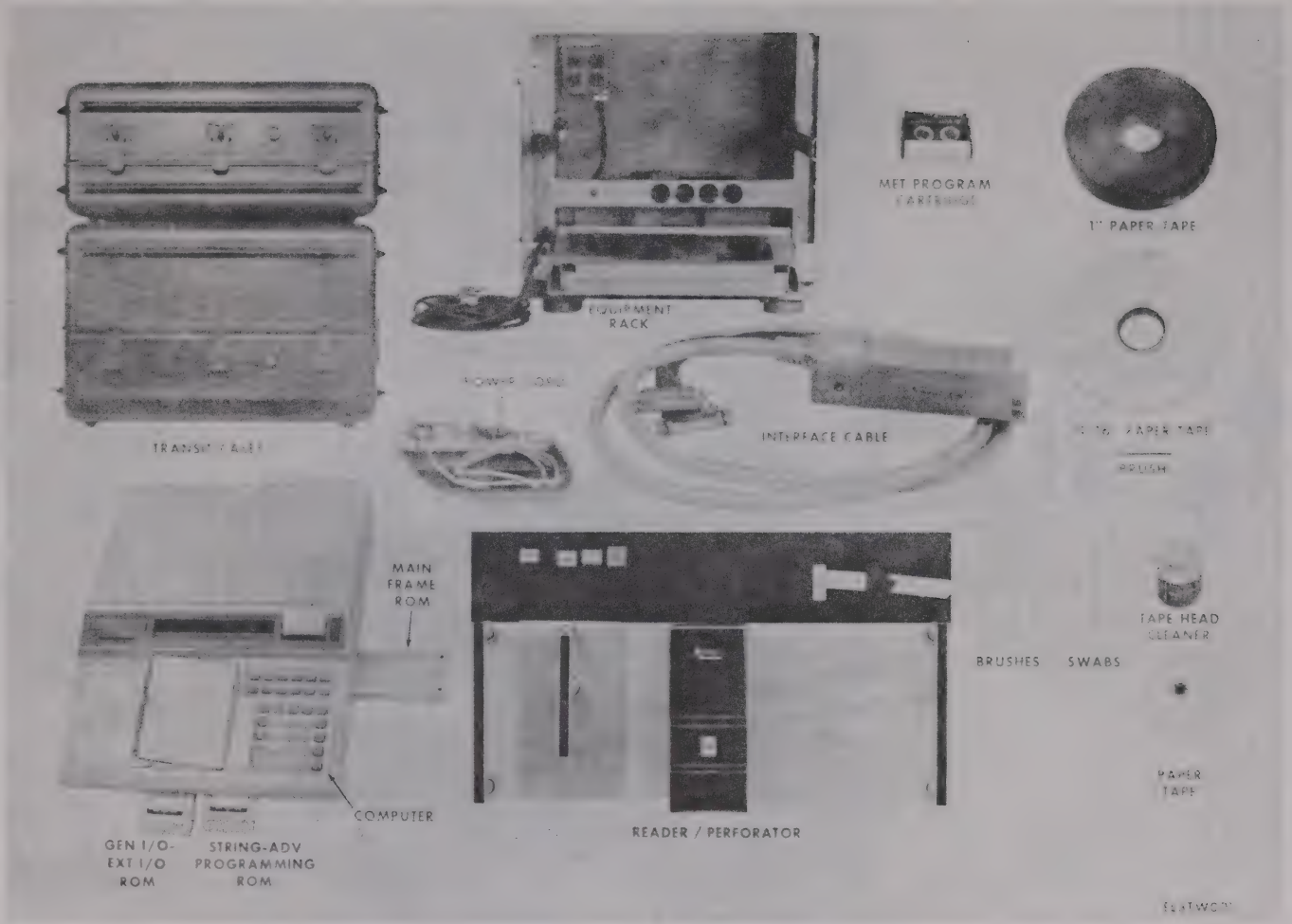


Figure 1. Meteorological Data Processing Group OL-192 (Major Components).

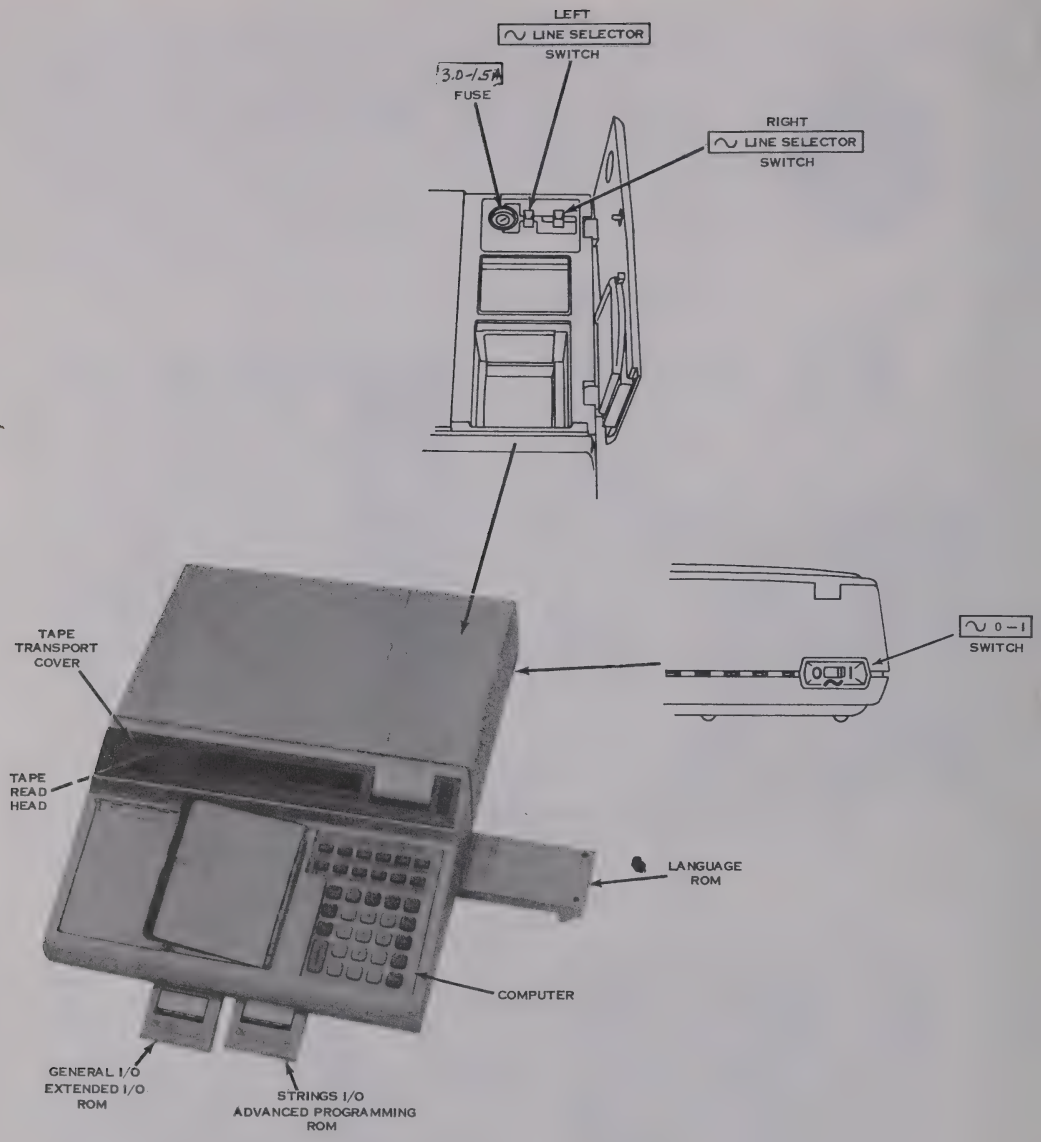


Figure 2. Computer HP9825A.

5. The reader/perforator can read and/or perforate a 5 channel baudot code or an 8 channel ASCII (AS-KEY) code. The reader converts the information stored in the form of punched holes on the paper tape into electronic signals, up to a rate of 300 characters per second. The perforator can punch standard 6 or 8 track paper tapes at speeds up to 120 characters per second.

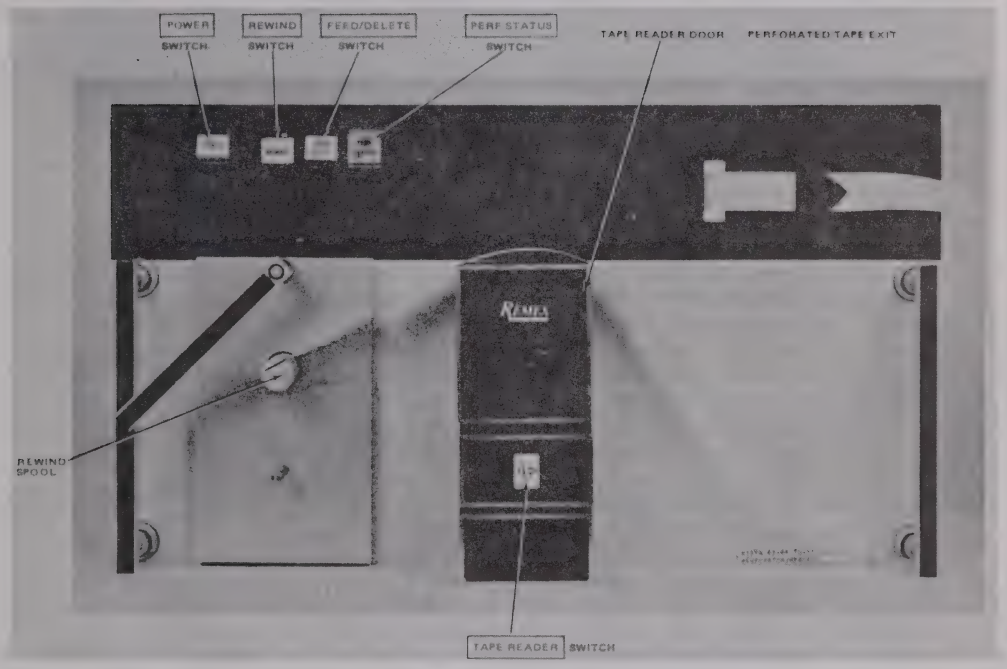


Figure 3. Reader/Perforator.

6. The interface cable (fig 4) provides the electrical connection between the computer and the reader/perforator. It transfers data between the computer and reader/perforator and carries commands from the computer to the reader/perforator. The interface cable is fragile and must always be handled with care.

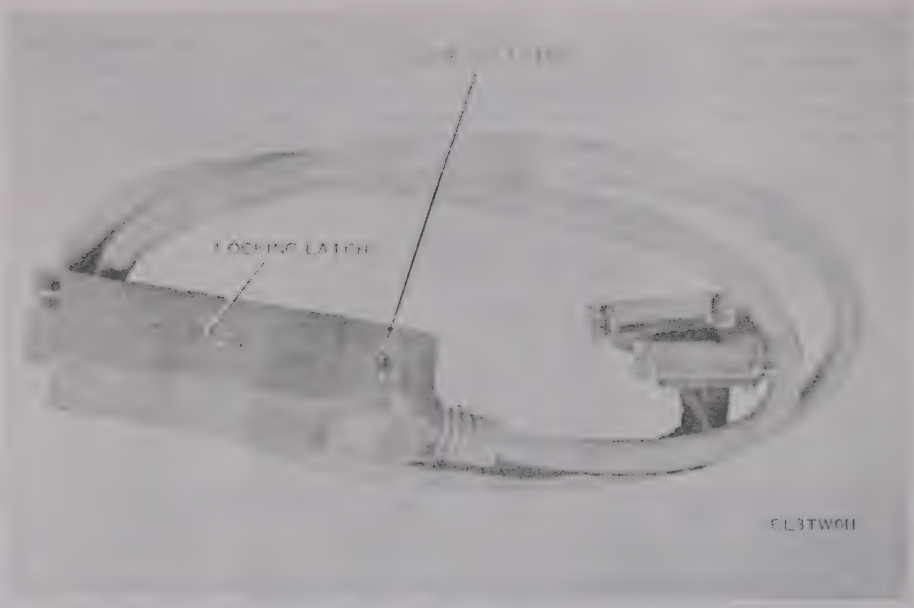


Figure 4. Interface Cable

7. The software consists of the Met Program Data Cartridge (fig 1) which is nothing more than a small version of a cassette tape. The programming of the computer is accomplished by inserting the cartridge into the computer and applying power. In approximately 6 seconds, the computer is programed and ready to start processing the raw met and wind data. One of the features provided by the met program software is that the LED display prompts the operator for each data entry. The audio alarm signals the operator to enter new met data or to answer questions. Met data is entered with the numeric keyboard, while the radiosonde pressure calibration data can be entered with either the numeric keyboard or the tape reader. The program will produce sound ranging, ballistic type 2 and 3, computer, fallout, and air weather service messages.

8. To operate the OL-192 properly and safely, you must have a thorough knowledge of the controls and indicators that are located on each component of the OL-192. We will first start with the controls and indicators on the HP-9825A mini computer. Use the OL-192 assigned to you, if available, and/or the figures in this reference note to assist you to locate the various controls and indicators as you read about them.

9. Computer HP9825A (fig 2)

Control or Indicator	Function
O-1 switch (ON/OFF)	In 1 position power is supplied to computer. In O position, power is removed from computer.

3.0-1.5A fuse (Located under paper bin cover.)	For 100 VAC or 120 VAC operation, 3 amp fuse is used.
LINE SELECTOR (Left and Right) switches (located under paper bin cover).	Two (2) position switches used to match computer input voltages as follows:

Voltage (VAC)	Left Switch	Right Switch
100	UP	UP
120	UP	DOWN
220	DOWN	UP
240	DOWN	DOWN

Tape Program Running Light	Glows to indicate tape is running, searching, loading a program, or recording data.
Tape Cartridge Ejection Bar	Ejects Data Program Cartridge.
Light Emitting Diodes (LED) display	Alphanumeric display shows all programed operator instructions. Displays all entered data for OL-192 operator's verification prior to printing and storage. Displays red busy indicator light to show that processor is busy and will not accept data. Displays error messages that are defined in error message booklet stored under the paper bin cover.
The Lazy "T"	This ⊢ symbol appears as the left most character of the display indicating that the computer is ready and awaiting inputs.
Paper advance wheel	Manual advance heat sensitive paper tape through the computer's thermal printer.

SPECIAL FUNCTION keys	Metallic engraved special function matrix identifies each key.
f_0	START - Starts met data processing by loading computer from the met program data cartridge.
f_1	CONT - Continues met processing after interruptions for corrections, deletions or message outputs.

f_2 LAST FLT - Recalls last flight from met data program cartridge storage. Key is programed as an operator's check of OL-192.

f_3 TACFIRE - Will be programed to communicate with TACFIRE weapons systems automatically.

f_4 P. TAPE - Programed to prompt operator through procedures to punch radiosonde pressure calibration tapes. Punched tape is automatically output.

f_5 PIBAL - Reserved for pibal programs.

f_6 INFO - Activates after operator presses the NO key. When pressed, computer prints processed met data beginning with the last significant data level down to surface, pauses, then outputs processed wind data from surface up to the height of the last significant met data level; then continues as if processing had not been interrupted.

f_7 OUTPUT - Activates after operator presses the NO key. When pressed, computer outputs a copy of all or any met message(s) desired.

f_8 DELETE - Activates after operator presses the NO key. Deletes punching or printing of unwanted met messages. Repeating NO-DELETE allows back stepping to correct errors or to pick up omitted data for processing.

f_9 NO - When pressed, caused automatic repeat of prompting to correct errors. Activates the INFO, OUTPUT, and DELETE keys. Also used as STOP processing key.

f_{10} YES - Used as a verifier key. When pressed, entered data is transferred from holding registers into memory for storage until required for processing and/or

	output. Questions that require verification will display a question mark (?).
f_{11}	DATA IN - When pressed, causes printer to print entered data, clears LED for next prompt and puts all data entries into holding registers until data is verified and placed in storage by the YES key.
Audible beeps	Are alerts to instructions that direct you to enter data specified by the LED display or perform actions as explained below: One (1) beep indicates that the LED display is a question to be answered using the YES or NO key. Two (2) beeps indicate that the LED is displaying a data entry or input request. Three (3) beeps indicate that performance type instructions are being displayed; i.e., load pressure tape, turn on Remex, etc.
Numeric and symbol keys	Standard computer functions as labeled with the exception of the * key, which has three functions: 1. As a multiplier key. 2. Used to indicate MISSING MET DATA LEVEL when used with reference ordinate values. 3. Used to indicate MISSING WIND DATA when used with elevation angle and causes computer to interpolate angular data after radiosonde has ascended at least 1,000 meters.
Alfa keys	Typical typewriter keyboard; prints as labeled. This keyboard is used when the operator types in a coded location requiring letters (normally capital letters).

10. READER/PERFORATOR (Figure 3)

Control or Indicator	Function
POWER switch and indicator	Supplies power to both tape reader and perforator. Push up, lamp

	illuminates, indicating power on, push down, lamp goes out and power is off.
REWIND switch	Operates tape rewind motor, is spring loaded off. Motor operates only while switch is pressed.
FEED/DELETE switch	3-way switch, spring loaded to center (or off) position. Pressing upper part (FEED) causes unpunched tape to feed out. Pressing lower par (DELETE) causes perforator to punch all channels.
PERF STATUS indicator	Illuminates when paper tape supply is low. Does not affect perforator's functioning.
Tape reader door	Door open, off condition for computer commands. Door closed, ready condition, awaiting computer commands. Tapes are read when computer YES key is pressed after LED prompt IS READER DOOR CLOSED?
Tape reader switch	Normal position is spring loaded to center (or off) position. Left side pressed, causes reader motor to drive tape left. Right side pressed, causes reader motor to drive tape right.

11. INTERFACE cable (Figure 4)

Control or Indicator	Function
Code selector	For OL-192 operation, MUST be positioned on 2.
Locking latch	Locks interface cable to computer.

12. ERROR MESSAGES: When a procedural or equipment error is detected by the computer, an error message is displayed on the LED. Following is a list of correctable error messages. These error messages and corrections apply only to electronic soundings. Error messages during visual soundings have no corrections other then turning the computer off and beginning again.

ERROR MESSAGES	CORRECTIONS
a. ERROR 07	Operator procedural error. Wrong special function key used. Press DATA-IN to clear error.

	ERROR MESSAGES	CORRECTIONS
b.	ERROR 09	Same as error 07.
c.	ERROR 64	Operator procedural error. Attempt was made to enter data when the computer is not ready to accept data, (red light glowing). Re-start flight.
d.	ERROR G-8	Perforator/reader out of tape. Replace tape. Press CONT.
e.	ERROR 15	Computer printer out of paper. Replace. Press CONT.
f.	ERROR 30	Tape cartridge not inserted properly. Check transporter slot and cartridge. Replace tape. Press CONT.
g.	ERROR 42	Tape record tab not in record position. Remove tape. Correct and replace tape. Press CONT.
h.	ERROR 44 OR 46	Tape problem. Read head dirty, or trash in tape transporter slot. Something is preventing the tape reader from reading the Met Program, correct malfunction. Press CONT.
i.	ERROR E4 in 322	Error in track E4 file 322. Remex not accepting command from computer to read calibration tape. (1) Check calibration tape a. Wrong end of tape. b. Tape not seated on sprocket. (2) Correct malfunction, then type CONT on the alphanumeric keyboard, and 322 on the numeric keyboard. Display will read CONT 322. Press EXECUTE.

13. Assembling the OL-192 in the classroom is a very simple procedure which involves connecting the interface cable to the computer and reader/perforator and connecting the power cables of the computer and

reader/perforator to an electrical outlet. The OL-192/GMD-1 in the met section to which you will be assigned may be mounted differently. You will have to refer to TM 11-6660-263-10 for the proper installation procedures.

Section II. FIGHT COMPUTATION

14. The OL-192 is programed to cause the light-emitting diodes (LED), to display visual operator input and output instructions. The program also causes the computer to beep audible instructions. These instructions lead you, the operator, through the procedures required to reduce raw met data to processed met data. To better understand the operations of the OL-192, you must have a thorough knowledge of the input and output instructions displayed by the LED display.

15. A brief explanation of the LED display follows:

a. The "lazy T" means that the computer is waiting for inputs from you.

b. The glowing red dot with the lazy T indicates that the program is loading the computer memories; therefore, no data can be entered. If the tape program is running, or processing, the glowing orange dot to the left of the cartridge eject button indicates that the program tape is winding or rewinding. After about 9 seconds, both glowing indicators go out and the computer printer begins to print the program title and date as the LED display begins prompting for data inputs.

c. Questions that require a verification response with the YES key or NO key display a question mark (?).

d. Entry response formats are displayed within brackets, indicating the number of digits required, the location of decimal points or hyphens, and the numerical limits of the response entry.

Entry response example: ENTER YEAR (1900 to 1999).

e. Action response formats are displayed as statements.

Action response example: LAUNCH FLIGHT.

f. Examine the response keys located on the special function keyboard and the numeric keyboard. They consist of the CLEAR, DATA IN, YES and NO keys. You must know the purpose of these keys and when to use them. Operational responses are keyed in as instructed by the LED display. The displays are then put into the holding registers by pressing the DATA IN key, which also cycles the LED display to the next instruction. If you notice that the date is incorrect before pressing the DATA IN key, you can press the CLEAR key and key in the correct data. At periodic programed phases, the computer printer automatically prints a copy of this data and the LED display will request verification of the data printed for that phase. The YES key verifies the data is correct; if the data is not correct, press the NO key and the program will repeat all requests for that phase.

16. In conjunction with the instructions displayed by the LED display are the audible prompting (beeps). Audible beeps that direct you to key in data specified by the LED display or perform actions are explained below:

a. One beep indicates that the LED display is a question to be answered by using the YES or NO key. The YES key is pressed to verify and enter the displayed data into memory. The NO key is pressed, when necessary, to correct a printed error, or to select a choice other than what is displayed.

b. Two beeps indicate that the LED display is a data input request. You respond by using an alphanumeric, numeric, or a special function key. Your response is displayed before it is entered. You should read each display and, if an error is observed, press the CLEAR key and rekey in the data. If the displayed data is correct, press the DATA IN key. Pressing the DATA IN key enters your displayed response into the holding registers and clears the LED display so that the next instruction can be displayed.

c. Three beeps indicate that performance-type instructions are being displayed by the LED display. Typical actions are to turn designated switches ON or OFF, load pressure tape, change paper tape, or calibrate the Q-5 recorder.

17. As mentioned in paragraph 14, you must have a thorough knowledge of the input and output instructions displayed by the LED. If you encountered any difficulties understanding paragraphs 14, 15 and 16 , it will be to your benefit to reread the paragraphs. If you think of the OL-192 as a machine that is talking to you by way of its LED display, and that you are answering it by use of the special function keys and the numeric keyboard, you should have no problem computing met messages.

18. When you remove the MET DATA PROGRAM CARTRIDGE from its plastic case and look at the front side of it, you will notice that in the lower right hand corner there is a small plastic slide, the word RECORD, and a small arrow. The slide must ALWAYS be to the far right position for both PIBAL and electronic flights (fig 5).

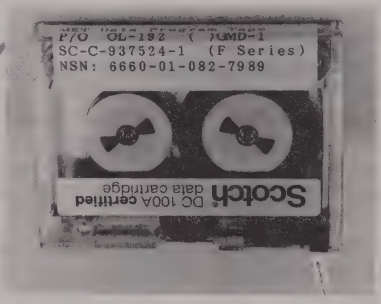


Figure 5. Met Data Program Cartridge

19. To install the cartridge in the computer properly, the back side (metal) of the cartridge must be facing you. Place the cartridge over the door of the cartridge slot and insert the cartridge. Notice that the cartridge eject button raises from its slot. To eject the cartridge just push the eject button in (down). Insert the cartridge. Once it is inserted properly, place the power on/off switch to the ON position to begin.

Section III. PIBAL PROCEDURES

20. If you have a computer, follow along and do the steps as indicated. Use the data from visual flight #1 at the back of this booklet. Remove the PIBAL tape from the case, insert it into the computer, and place the power on/off switch to the ON position. You will notice that the LED display USE FUNCTIONAL KEYS TO ACTIVATE is preceded by a glowing red light. Remember, anytime this red light is glowing, you are not to enter any data into the computer by using the numeric or special function keys.

21. When the glowing rd light goes out, press the PIBAL key. The LED will display "PROCESSING PIBAL." Then it will display "ENTER YEAR (1900-1999)". Enter the year the flight was released. The LED will then request the month, date, and time (GMT) separately.

Note. All data is keyed in using the numeric or alpha keys as indicated, but it is NOT loaded into the computer until the DATA IN key is pressed. Remember to check the data on the LED display before you press the DATA IN key. If you make a mistake, press the clear key and key in the correct data, check it, and then enter it into the computer with the DATA IN key. Key in each item using the numeric keys, check the data, and enter it into the computer with the DATA IN key. After the last entry, the LED will display "IS THE DAT 28 1500Z JUN 85?"

This requires a yes or no response. If the data is incorrect press NO and the computer will ask you for the data and time again.

22. The LED will display "TIME DATA DISPLAY" and then display "ENTER LOCAL TIME (0001 to 2400)". Key in the local standard time at the start of the flight and, if correct when displayed, enter it. A request for verification is displayed on the LED which requires a yes or no response.

23. The LED will display "ENTER SUNRISE TIME (0001 to 2400)". After determining the sunrise time (local standard) key in the time and enter it. A request for verification is displayed on the LED which requires a yes or not response.

24. The LED will display "ENTER SUNSET TIME (0001 to 2400)". Key in the sunset time (local standard) and enter it. A request for verification is displayed on the LED.

25. The LED will display "RAIN, DRIZZLE or FOG?". If any of the above is occurring, press the YES key. Press the NO key if any of these conditions are not present.

a. A YES key response causes the LED to display "ENTER WEATHER CONDITION". Using the alphanumeric keyboard spell out and enter the appropriate condition--(either RAIN, DRIZZLE or FOG). The LED will display "IS SKY HALF TO TOTAL OVERCAST?". A yes or no response is required. If the yes key is pressed, the computer will print the weather condition and "OVERCAST".

b. If the sky is less than half overcast, then the NO key is pressed and the computer will print the weather condition and "CLEAR SKY".

c. A NO key response to the RAIN, DRIZZLE or FOG display causes the LED to display "IS SKY HALF TO TOTAL OVERCAST?". Remember, the sky can be overcast without precipation. A YES or NO response is required. If the YES key is pressed, the computer will print "OVERCAST". If the NO key is pressed the computer will print "CLEAR SKY".

26. The LED will display "PERFORM SURVEY CONTROL", then it will prompt you through the procedures of entering the survey or location data.

a. The LED will display "ENTER STATION ELEVATION (METER)". The station elevation is entered to the nearest meter.*

*Note. Height is in tens of meters on DA 4524.

b. The LED will display "ENTER LATITUDE (00 to 90.0)". Enter station latitude to the nearest tenth of a degree.

c. The LED displays "ENTER LONGITUDE (0.0 to 99.9)". Key in the station longitude to the nearest tenth of a degree.

d. The LED displays "ENTER OCTANT (0 to 8, not 4)". Determine station octant and key in the octant number by using the numeric key and

enter it. This time, the computer will print the survey control data, and the LED will display "IS SURVEY DATA CORRECT?". A YES or NO response is required.

e. If the NO key is pressed, the computer will require you to perform another Survey Control.

f. If the YES key is pressed, indicating that the Survey Control data was entered correctly, the computer will then print "SFC WIND VALUES AT TIME "0"".

27. SFC WIND VALUES AT TIME "0" tells you that all data for Survey Control or location data has been entered into the computer and that the computer is now ready to accept the surface weather data. Just prior to, and during balloon release, you, as the OL-192 operator, will control the data collection process, and enter the data on the wind computation form, DA Form 4469. The accuracy of all data must be checked prior to entry into the computer. Just before the balloon is released, the theodolite operator will read the azimuth to the offset point to the nearest whole degree. Enter this direction on the surface line under column 6 (Azimuth Angle). While at the offset point, measure the surface wind direction and speed with the hand held anemometer and enter the data under columns 10 and 11 on the surface line of the wind computations form. As soon as the balloon is released, turn and walk to the theodolite counting the paces until you reach the theodolite. Convert this distance to meters and enter it on the surface line under column 7 (Horizontal Distance). As the theodolite operator tracks the balloon you will record the angles under columns 5 and 6.

28. The LED will prompt you through all of the entries for surface wind data as follows:

a. The LED will display "ENTER AZIMUTH OFFSET AT LAUNCH". Look at the wind computation form on the surface line under column 6, (Horizontal distance). Key in the azimuth angle with the numeric keyboard and enter it.

b. The LED will display "ENTER HORIZONTAL DISTANCE OFFSET". Key in that distance from column 7 of the form using the numeric keys and enter it.

c. The LED will display "ENTER SFC WIND DIRECTION". Key in the surface wind direction from column 10 using the numeric keys.

d. The LED will display "ENTER SFC WIND SPEED". The surface wind speed is on the surface line under column 11. Key in the surface wind speed.

e. All surface wind data is now entered into the computer. The LED displays "ARE PRINTED SFC WIND VALUES OK?". This question requires a YES or NO answer. A NO answer (using the NO key) causes the LED to display "ENTER AZIMUTH OFFSET AT LAUNCH" again, then all surface wind data must be reentered. A YES answer will cause the LED to display "ENTER SURFACE PRESSURE AT LAUNCH".

29. The next series of entries are the surface temperature and pressure data.

a. The LED will display "ENTER SURFACE PRESS AT LAUNCH". Key in the pressure to the nearest 0.1 millibar.

b. The LED will display "ENTER SFC TEMPERATURE (deg C)". Key in the dry bulb temperature to the nearest 0.1 degree.

c. The LED will display "ENTER WET BULB TEMP (deg C)". Key in the wet bulb temperature to the nearest 0.1 degree.

d. The LED will display "ARE SFC VALUES OK?". You should verify the printed values for surface pressure and temperatures. If the data is incorrect press the NO key and repeat the pressure and temperature steps. If the data is correct press the YES key and the computer will print the humidity and virtual temperature values.

e. The LED will display "ENTER MEAN SURFACE DENSITY". Key in the mean surface density to the nearest 0.1 g/m^3. The computer will print the surface density and the mean surface density.

f. The LED will display "ENTER BALLOON WEIGHT (gms)". Key in the balloon weight in grams (30 or 100). The LED will display "IS BALLOON WEIGHT OK?". A YES or NO answer is required. A NO answer will cause the computer to display "ENTER BALLOON WEIGHT (gms)" again. A YES answer will cause the LED to display "WAS HELIUM USED FOR INFLATION?". This display only requires a YES or NO answer. If hydrogen was used press NO. If helium was used press YES. The computer will then print the type of gas used to inflate the balloon.

30. After the type of gas is printed the LED will display "ENTER OBSERVATION TIME". With this display you have completed the surface data and are ready to enter the upper air data. The observation times are the times at the top of each zone which are printed onthe wind computation form in column 1. Before these times can be entered into the OL-192 they must be converted from minutes and seconds to minutes and tenths of a minute. This is done prior to release of the balloon and entered in column 4 of the wind computation form. You must ensure that the time column selected matches the balloon size used for the flight.

a. Key in the observation time from column 4.

b. The LED will display "ENTER ELEVATION ANGLE AT TIME XX". Column 5 contains the elevation angle for each top of zone time. Key in the elevation angle and enter it.

c. The LED will display "ENTER AZ ANGLE AT TIME XX". The azimuth angles are in column 6. Key in the azimuth angle.

d. The LED will display "ARE PRINTED DATA OK?". This requires a YES or NO response. If an angle is incorrect, press NO and the computer will request the data to be re-entered. If the angles are correct, press YES and the LED will display "ENTER OBSERVATION TIME". As the computer

operator, you will continue to enter data at the top of each zone until the end of the requirement, a low ceiling, or balloon burst, causes termination of the flight. In order to let the computer know when the end of the requirement or termination is reached, press the asterisk (*) key and the DATA IN key, in that order, when "ENTER OBSERVATION TIME" is displayed.

31. The LED will display "DO YOU WANT ZONE INFORMATION?". This display requires a YES or NO response. The zone information gives detailed data about each zone. In most cases a NO anwser will be given.

32. The LED will display "ENTER REGION NUMBER". There are seven climatic region in the northern hemisphere as shown on the map at page 1-2 of FM 6-16-2.

a. Key in the Region and enter it with the DATA IN key.

b. The LED will display "ENTER MESSAGE TYPE". Key in a 2 for a ballistic type 2 message or a 3 for a ballistic type 3 message.

c. The LED will display "ENTER PERIOD". The period of the day, (night, afternoon, or transition) is spelled out using the alpha keys. Type in the period and enter it with the DATA IN key. The computer will print DEPARTURE X.X and the numerical values of departure from mean surface density for 15 lines.

33. The LED will display "TURN ON REMEX". The computer will print PIBAL FLIGHT, and the date/time group of the flight, then automatically go into message output and print the sound ranging message and ballistic type 2 or 3 message. When the computer completes the printout of the messages the LED will display "USE FUNCTIONAL KEYS TO ACTIVATE". This completes the processing of the data for the PIBAL flight. Eject the tape and turn the computer off. PIBAL flights #2 and #3 may be used for more practice in the operation of the OL-192 computer.

Section IV. ELECTRONIC PROCEDURES

34. When using the OL-192 to compute electronic met messages, you will need the radiosonde data sheet which contains the heading data for the message and the uncorrected data from the Q-5 chart. You also need the pressure calibration chart and/or tape, the control recorder tape, the linearity calibration chart, and the additional data printed on the bottom of the form. At the end of this RN there are three radiosonde data sheets numbered 1, 2, & 3. There is also a radiosonde calibration chart, a control recorder tape and a linearity calibration chart. These last items can be used for all three exercises. We will use the first sounding to explain each step.

35. Insert the electronic sounding tape and turn on the computer as you did in the pibal portion. The computer will print the type of tape used and the LED will display "USE FUNCTIONAL KEYS TO ACTIVATE". This time press the START key. The LED will display "PROCESSING START OF FLIGHT", and then display "ENTER YEAR (1900 to 1999)". If you have forgotten the purpose of the various keys, re-read the paragraph on CONTROLS AND INDICATORS.

36. The computer is asking for the year the flight was worked. Look at the preflight time box, the GMT date and time is 17 May 1984 at 1420 hrs.

a. Key in 1984 and enter with the DATA IN key. All data has to be entered using the DATA IN key. I will not tell you each time to use the DATA IN key.

b. The LED now displays "ENTER NUMBER OF MONTH (1 to 12)". Key in 05 for the month of May.

c. The LED will display "ENTER DAY OF MONTH (1 to 31)". Key in 17.

d. The LED will display "ENTER ZULU TIME (0000 to 2359)". GMT and Zulu times are the same, so key in 1420.

e. All data for the date time group is now in the computer. The LED will display "IS THE DATE 17 1420Z May 84?". Compare the data on the radiosonde data sheet with the LED display. If the display is incorrect key NO and the LED will display "ENTER YEAR (1900 TO 1999)" and all data can be re-entered. If the display is correct key YES and the LED will display "17 1420Z May 84". The computer will print the date time group and the LED will display "IS SURVEY OF 04 1713Z Dec 84 OK?".

37. The survey data is the location of the met section which includes the octant, longitude, latitude, and height above mean sea level in meters. This display requires a YES or NO response. A NO response will cause the computer to request all the survey data to be re-entered. As a rule, this data needs to be re-entered only if the section has moved recently. The YES response causes the computer to print the survey data already in the computer. Press the NO key.

a. The LED will display "PERFORM SURVEY CONTROL", then will display "ENTER STATION ELEVATION (METERS)". The survey data is added to the bottom of the radiosonde data sheet. Key in 360. The LED will display "IS THE STATION ELEV 360 METERS?". This requires a YES or NO entry. A NO entry will cause the LED to display "ENTER STATION ELEVATION (METERS)". Press NO and re-enter 360. A YES entry will cause the LED to display "IS THIS A CODED LOCATION?".

b. A coded location requires a code for your location instead of actual longitude and latitude values. Press the NO key. The LED will display "ENTER LATITUDE (0.0 to 90.0)". Key in 34.7. The LED will display "IS THE LATITUDE 34.7 DEGREES?". A YES or NO response is required. A NO response will require the latitude to be re-entered. Key in YES if the data is correct. A YES entry will cause the LED to display "ENTER LONGITUDE (0.0 to 99.9)". Key in 98.3 and the LED will display "IS THE LONGITUDE 98.3 DEGREES?". Again, a YES or NO response is necessary. Key in YES if the data is correct, NO if incorrect and re-enter the longitude.

c. The LED will display "ENTER OCTANT (0 to 8 not 4)". Key in 1; our location is in the first octant. The LED will display "IS OCTANT 1?". A YES or NO response is required. Notice that the computer wants you to be very sure that the data you are entering is correct. Press the YES key. The LED will display "SURVEY DATA" and the computer will print the data.

d. Once the survey data is entered, the LED displays "IS A TTY-76 TELETAPE NEEDED?". A YES key response causes the reader/perforator to punch a tape acceptable to the current RATT rig and FADAC mechanical tape readers. A NO key response causes the reader/perforator to punch a tape acceptable for the UGC-74, a future high-speed data transmission system. Both the YES and NO response cause the LED display to remind you to check the size of the paper tape protruding from the punch. For the flights in this exercise, answer using the YES key.

38. The LED will then display "IS RCD CK OF 04 2121Z Mar 85 OK?". The date time group here (04 2121Z Mar 85) will be the last time your radiosonde recorder calibration was checked, so any date time group may be displayed. The linearity calibration is a check made by the unit equipment mechanic to determine exactly where the pen prints at 11 known frequencies. If a tolerance of 0.3 recorder divisions is exceeded the Q5 must be re-aligned. These exact recorder divisions must be entered into the computer each time the linearity calibration is performed. A YES entry will cause the computer to print the linearity calibration data. For this exercise let's assume that the equipment mechanic has just completed the linearity calibration and has drawn a linearity calibration chart on the portion of the Q5 chart on page 38 . Press the NO key.

a. The LED will display "PERFORM LINEARITY CALIBRATION CHECK". Then it will display "ENTER RCD SERIAL NUMBER (XXXXXX)". The serial number of our Q5 (recorder) is 000003. All six digits must be entered. Key in 000003. The LED will display "IS SERIAL NUMBER 000003?". A YES or NO response is required. If the serial number is correct key in YES, if not, key in NO and re-enter the serial number. When YES is entered the LED will display "ENTER RCD ORDINATE AT 190 HERTZ". The Q5's pen will print at exactly one half of the input signal so the ordinate (recorder division) at 190 Hz should be 95.0. Our linearity calibration chart shows 95.0. Key in 95.0. The LED will display "ENTER RCD ORDINATE AT 180 HERTZ". Key in 90.0. The eleven numbers (plus zero) directly under the recorder division numbers on the Q5 chart are the linearity calibration recorder divisions. Remember, each display is double the recorder division that must be entered. A 120 display requires that you enter 60 recorder divisions. For the 100 display, you will enter 49.9, for 80, 39.9 for 60, 30.0 and for 40, 19.9. After all the recorder divisions, including 0.0, have been entered, the LED will display "AN/TMQ-5 RECORDER LINEARITY DATA". At this time if one or more of the entries are out of tolerance (more than .3 of a recorder division) or if you made a mistake and pressed the wrong key, the LED will display "REPAIR RECORDER, THEN TRY AGAIN", and the computer will print 'OUT OF TOLERANCE VALUES INDICATED BY AN (*)", "OUT OF TOLERANCE VALUES MAY BE EITHER (+) OR (-)". Then "RECALIBRATE RCD". The LED will display "ENTER RCD ORDINATE AT 190 HERTZ".

39. Once the linearity calibration is entered, the LED will display "AN/TMQ-5 RECORDER LINEARITY DATA" and the computer will print the linearity calibration data, then the LED will display "IS AN/AMT-4 SONDE BEING USED?". This display requires a YES or NO response. A YES respnse will cause the computer to print "RADIOSONDE TYPE: ARMY AN/AMT-4". A NO response causes the LED to display "USING NWS RADIOSONDE J031 SERIES". Here, at the school, only the J031 radiosonde is used, so press the NO key. The NO response causes the computer to print "RADIOSONDE TYPE: NWS J031 SERIES".

40. The LED then displays "DO YOU HAVE A PRESSURE TAPE?". This pressure tape is a punched tape of the data printed on the pressure calibration chart. In the near future, all radiosondes will have a pressure calibration tape issued with them, which can then be entered into the computer via the reader/perforator. A YES response to the display "DO YOU HAVE A PRESSURE TAPE?" will cause the LED display to lead you through the steps to load the tape in the tape reader. The tape reader loads the computer in about 5 seconds. Since there is no tape included with Flight #1, press the NO key. The LED will display "PERFORM BAROSWITCH CALIBRATION", then "ENTER PRESSURE AT CONTACT NO 1". The computer will direct you through the first of two alternate methods of entering the pressures from the pressure calibration chart. The first alternate method is known as the 15 CONTACT method and is programmed to operate automatically whenever the pressure calibration tape is missing or damaged. The LED displays (one at a time) 14 predetermined contacts. These contacts are 1, 5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 100, 120 and 140. The 15th predetermined contact is the last contact on the pressure calibration chart having a printed pressure value, normally between 162 and 180 contacts.

a. Using the pressure calibration chart, enter the pressures as the LED display calls for them. The pressure for contact No 1 is 1061.2, enter the first 14 pressures now. The 15th predetermined contact in our case is 163. The LED will display "ENTER CONTACT NO OF LOWEST PRESS". Key in 163. The LED will display "ENTER PRESSURE AT CONTACT 163". Enter 3.2 millibars. The LED will display "BAROSWITCH PRESSURE DATA" and then the computer will print the pressures for all 15 contacts. After the pressures are printed the LED will display "ARE PRINTED PRESSURES CORRECT?". Recheck the printed data against the pressure calibration chart. A YES or NO response is required. If an error exists, press the NO key and the LED will display "ENTER PRESSURE AT CONTACT NO 1". Re-enter all 15 contacts. If the pressures are correct, press the YES key and, if the computer accepts the data, the next LED display will be "ENTER SFC PRESS (650.0 to 1100)".

41. If for some reason the computer will not accept the 15 contact method, the second of the two alternate methods must be used. The LED will display "PRESSURES CALIBRATION TAPE NEEDED". The next LED display is "IS REMEX OPERATIONAL?". A NO key entry will cause the LED to display "ENTER SERIAL NUMBER (XXX-XXXX)". The entry must be made as shown. After the radiosonde serial number (612-1565 for this flight, found in the upper left corner of the calibration chart) is keyed in, the LED will display "ENTER DETENT VALUE (.XX)". Key in the detent value (.55 for the radiosonde, found across from the serial number on the calibration chart). The LED will display "ARE PRINTED CHART VALUES OK?". A YES or NO response is needed. A NO entry will cause the computer to display "ENTER SERIAL NUMBER (XXX-XXXX)" again. A YES response will cause the LED to display "ENTER PRESSURE AT CONTACT 1". Enter the pressure at the first contact and each contact thereafter. Once enough pressures are entered for the sounding requirement, key in 00 and press the DATA IN key. The LED will display "ENTER SFC PRESS (650.0 to 1100)".

Key in the surface pressure to the nearest 0.1 millibar, (977.1 as shown on the radiosonde data sheet). The LED will display "ENTER CONTACT BELOW SFC PRESSURE". Our surface pressure is 977.1. This pressure falls between contacts 7 and 8, therefore the contact below surface pressure is 7. Key in 7 and the LED will display "ENTER PRESSURE AT CONTACT 7", then

key in 983.8 millibars. The LED will display "ENTER PRESSURE AT CONTACT 8". Key in 971.4. The LED displays "ARE PRINTED DATA OK?". Compare the printed data with the data you keyed in. A YES or NO response is required. A NO response will cause the computer to request all pressure data. A YES response causes the LED to display "PRESSURE CALIBRATION IS OK", then "PERFORM BASELINE CALIBRATION" then "ENTER BASELINE DRY BULB TEMP". The data for the baseline in the case of the J)31 Radiosonde is on the radiosonde data sheet under the title, Preflight Circuit Check. The dry bulb temperature is 30.0 C. Key in 30.0 and the LED will display "BASELINE CALIBRATION NEEDED?". The J031 is pre-basedlined so key in NO. The LED will display "ENTER BASELINE REFERENCE R.D.". The reference R.D. is always 95.0 so key in 95.0. The LED will then display "ENTER BASELINE TEMP RECORDER DIV". Key the recorder division for temperature shown on the radiosonde data sheet (in our case 73.42). The LED will display "ENTER BASELINE HUM RECORDER DIV". Key in the recorder division for humidity, (78.18). The LED will display "ENTER TEMP LOCK-IN RESISTANCE". Key in the five digit figure for ohms, (14042). The LED will display "ENTER HUM LQCK-IN RESISTANCE". Key in 10370. The computer will print all the calibration data and the LED will display "ARE PRINTED BASELINE VALUES OK?". A YES or NO response is necessary. A NO response will require all preflight circuit check data to be re-entered. Check the data carefully and, if correct, enter YES. The LED will display "BASELINE CALIBRATION COMPLETED" and then display "DO YOU WANT TAQ MET?". Key in NO. The LED will display "ENTER ZULU TIME (0000 to 2359)".

42. With this display we have completed the calibration portion of the sounding. The next entries will take us into the release data. The LED display "ENTER ZULU TIME (0000 to 2359)" is requesting the time Zulu (GMT) that the balloon was released. This time is found in the Launch Time GMT block of the radiosonde data sheet. Key in 1440. The entry of the launch time completes the preflight circuit check (baseline check) portion of the sounding.

43. The release data block will be used in the following entries. When the launch time is entered the LED displays "ENTER AZIMUTH OFFSET AT LAUNCH". The azimuth offset is the direction the balloon was from the GMD at release. Generally, the zero line of the control recorder tape will show this angle. Key in 300. The LED will display "ENTER HORIZONTAL DISTANCE OFFSET". This is the distance from the GMD to the release point in meters. Key in 50.0. The LED will display "ENTER SFC WIND DIRECTION (deg.)". Key in 300.1. In this case the wind direction and the horizontal direction to the release point are the same. In other cases, they may differ. The LED will display "ENTER SFC WIND SPEED". Key in the wind speed of 10 knots. The LED will display "ARE PRINTED SFC WIND VALUES OK?". Compare the data printed with the radiosonde data sheet. If the values are the same, a YES response is necessary. If not, a NO response is given and all SFC wind data is re-entered.

44. The LED will display "ENTER SURFACE PRESSURE AT LAUNCH". Our surface pressure is 977.1, the same as during the baseline portion. Key in 977.1. The LED will display "ENTER SFC CONTACT AT LAUNCH". If the pressure has not changed neither will the contact. Key in 7.5. The LED will display "IS LAUNCH SFC PRESS OK? 977.1". Respond with a YES or NO. If the response is NO the computer will return to "ENTER SURFACE PRESS AT LAUNCH" and all surface data must be re-entered. A YES response will cause the

LED to display "IS SFC CONTACT CORRECT? 7.5.". Again, a YES or NO response is required. A NO response will cause the LED to display "ENTER SFC CONTACT AT LAUNCH" and again, all surface data must be re-entered. At this point, the computer will compare the surface contact and the surface contact at launch. If a difference of more than 2.0 contacts exists, the computer will print "SFC PRESSURE DIDN'T CORRELATE WITH PRESSURE AT BASELINE; THEREFORE, THIS FLIGHT IS TERMINATED BUT IF EITHER A CONTACT OR PRESSURE ERROR IS FOUND THE FLIGHT MIGHT BE SALVAGED BY RE-ENTERING ALL DATA FOR THIS FLIGHT." Then the LED will display "PREPARE FOR NEXT FLIGHT." and then "ENTER YEAR (1900 to 1999). A YES response to LED display "IS LAUNCH SFC PRESS OK? 977.1" will cause the LED to display "ENTER SFC REFERENCE RD (tenths)". This data is found on the SUR or 0 line of the radiosonde data sheet. Key in 95.0 and the LED will display "ENTER SFC TEMPERATURE RD (tenths)". Key in 70.6. The LED displays "ENTER SFC HUMIDITY RD (tenths)". Key in 56.4. The LED then displays "ARE RD's FOR REF, TEMP & HUM OK?" A YES or NO response is required. A NO response causes the LED to display "ENTER SFC REFERENCE RD (tenths)" and all data after the reference has to be re-entered. A YES response causes the computer to print "AUTO PRESS CONT CORRECTION Ø.Ø". The computer would automatically correct each contact entered if there had been a contact correction on the surface level. In this case there was no contact correction. The LED will display "NEED USAF WMO MESSAGE?". We will produce air weather messages on all four soundings so key in YES. The LED displays "ENTER USAF (IIiii) LOCATION CODE". The USAF location code is a five digit number for each reporting location, in our case (Ft. Sill) the number is 72355. Once the location is entered the LED will display "IS PRINTED USAF CODE CORRECT?". A YES or NO response is required. A NO response will return to the LED display "NEED USAF WMO MESSAGE?". All data must be re-entered. A YES response will cause the computer to print "USAF Code: 72355" and the LED to display several items. "OK FOR MESSAGE HEIGHT TO 100 METERS.", "ENTER SIG LEVEL #1", and "ENTER PRESS CONTACT: 18.1".

45. The display "ENTER PRESS CONTACT 18.1" is actually the contact of the first mandatory level. The computer is waiting for the first significant level. Each level listed on the radiosonde data sheet is a significant level. Enter contact 9.3, the contact for level 1. The LED will display "ENTER TIME (0.01 to 150 minutes)". Level one time is 0.38, so enter this time. The LED displays "ENTER REFERENCE ORDINATE (Tenths)"; enter 95.0. The LED displays "ENTER TEMPERATURE RD (Tenths)"; enter 69.4. The LED displays "ENTER HUMIDITY RD (Tenths)": enter 42.6. Once the data for that significant level is entered, the computer will print the data and the LED will display "IS PRINTED DATA FOR SIG LEV OK?". Double check the data and enter YES or NO as required. A NO response will require the first level to be re-entered.

46. The YES response causes several LED display changes. The first display: "TEMP LAPSE RATE (DEGREES/KM)" indicates the direction or slope of the temperature trend between levels. The next display is "EVALUATE SIGNIFICANT LEVEL #2." Each significant level will be entered as the LED requests the data. The same procedures used for level 1 will be used until the program memory has stored sufficient time, pressure, temperature, and humidity data to satisfy either a complete sound ranging or artillery zone. When enough met data is stored, a winds data request is displayed: "ENTER ELEV ANGLE AT TIME XX.X". This remains displayed until the winds data

entry begins. For Flight #1, enough met data has been put into memory to satisfy the requirement for several sound ranging zones, and the LED displays "ENTER ELEV ANGLE AT TIME 0.4". Look at your control-recorder tape and obtain the elevation angle for 0.4 minutes (25.90) and key it into the computer. The LED then displays "ENTER AZ ANGLE AT TIME 0.4". Obtain the azimuth angle (347.15) and key it into the computer. The LED again requests the elevation and azimuth angle for the next higher tenth (.1) of a minute. Enter elevation and azimuth angles at time 0.5. The purpose of this is to enable the computer to interpolate between the two sets of angles to determine the exact angles at the top of the zone. Once all the data is entered, the LED will display "ARE PRINTED ANGLES FOR TIME OK?". Compare both the elevation and azimuth angles with the ones printed on the control-recorder tape, if correct, press the YES key; if not, press the NO key and re-enter the data as requested. Pressing the YES key puts the data into memory and causes the LED to display "OK FOR MESSAGES TO HEIGHT XXXXX" and then requests data for another significant level or the next zone's wind data. You will find that all the rest of the entries which you have to make will be repetitious and that you should have no problem understanding the LED's request for data. Enter the data for each level up to , and including, level #4.

47. Level #5 is the first mandatory level. The program will not permit you to omit or bypass a mandatory level, unless that particular level is within an area of missing data. If you try to enter 20.5 (level 6) instead of the mandatory contact 18.1 the LED will display "ENTER MANDATORY CONTACT" and then re-display "ENTER PRESS CONTACT: (18.1)". Enter the data for level #5.

48. There is a way to bypass a mandatory level or a significant level, if the level falls within an area of missing data. Look at level #6 on your radiosonde data sheet. Notice that there is no temperature or humidity data for this level. This is an example of a significant level within an area of missing data. You will also nótice an asterisk (*) to the right of the reference value. This is how you pass this significant level. Go ahead and key in the requested data for level #6, to include the asterisk (*) with the reference. When 95.0*
is entered, the LED displays "DOES MISSING DATA STOP HERE?". The answer to this request is NO. Upon pressing the NO key, the LED displays "IS MET DATA MISSING AT CONTACT?". The answer to this request is YES, since the met data is missing at this level. Pressing the YES key causes the printer to print "TEMP & HUMIDITY ARE MISSING AT THIS LEVEL", while the LED displays "EVALUATE SIGNIFICANT LEVEL #7" and "ENTER PRESS CONTACT (32.2)".

49. Evaluate Level #7, being sure to enter the asterisk (*) with the reference. When the LED displays DOES MISSING DATA STOP HERE? answer with the YES key, since you have met data for this level. Once the YES key is pressed, the printer prints "MET DATA RESUMES HAD BEEN MISSING", and the LED displays "ENTER TEMPERATURE RD (tenths)". Finish entering the rest of the met data for Level #7, and the angular data for 4.2 and 4.3 minutes only.

50. After the angular data for 4.2 and 4.3 minutes has been keyed in and verified, enter significant level #8. Suppose that some time after 5.2 minutes the control recorder ran out of paper or the paper advance

mechanism failed. It would be nearly impossible for you or any one else to stand by the control-recorder with pencil and paper copying the angular data every six seconds (10 prints per minute). All you have to do is change the PRINTS PER MINUTE switch on the control-recorder to 1 or 2 prints per minute and copy the angular data once or twice a minute. When this occurs, there has to be a way to let the computer know that you are going to enter angular data on the half or whole minute. This is done by using the asterick * again. Let's assume that the control-recorder ran out of paper and that the PRINTS PER MINUTE switch on the control-recorder has been placed in the one print per minute position. This can be done only after the radiosonde has ascended over 1000 meters. The LED is displaying "ENTER ELEV ANGLE AT TIME: 5.5". Instead of keying in the elevation angle at 5.5 minutes, key in 1.0*. This tells the computer of the change, and the LED displays "ENTER ELEV ANGLE AT TIME: 5.0". Enter the angular data for 5.0 minutes. After the angular data for 5.0 minutes is verified, the LED displays "ENTER ELEV ANGLE FOR TIME: 6.0". Now let's assume that a new roll of paper has been put in the control-recorder and that it is printing again at 10 prints per minute. Instead of entering the elevation angle for 6.0 minutes, key in .1* and the LED will display "ENTER ELEV ANGLE AT TIME: 5.5". If you had wanted to inform the computer that the control-recorder was printing at 2 prints per minute, you would have entered .5* instead of the 1.0*. Key in the necessary data to complete levels 8 and 9 when requested by the LED display.

51. Now that you have entered all the data for the 9 significant levels, and have assumed that the flight is complete, suppose the Q-5 operator informs you that he had made a mistake in Level #9? Correcting this error is a very simple process. When the LED displays "EVALUATE SIGNIFICANT LEVEL #10" and "ENTER PRESS CONTACT (32.2)", press the NO key. Pressing the NO key causes the LED to display "DELETE", "OUTPUT", "INFO" ACTIVE". What this means is that the DELETE, OUTPUT, AND INFO keys on the SPECIAL FUNCTION keyboard are active and can now be used. Press the DELETE key since you want to delete some bad met data. The DELETE key causes the LED to display, in sequence, "DELETING SIGNIFICANT LEVEL", "EVALUATE SIGNIFICANT LEVEL #9", and "ENTER PRESSURE CONTACT: (32.2)". At the same time, the printer prints "REPEATING LEVEL". By repeated use of the NO and DELETE key, you can delete all of the levels necessary in order to correct erroneous data. Enter level #'s 10 thru 16.

52. Since you have entered all the required data for Flight #1, I'm sure you would like to see the results of your work. At this time, press the NO key and when the LED displays "DELETE", "OUTPUT", "INFO" ACTIVE", press the OUTPUT key. The LED then displays "TURN ON REMEX". Reach over and turn on the remex (Reader/Perforator). The first message you will receive is the sound ranging message. So sit back and watch the fruits of your labor appear.

53. The "INFO" key, on the special function keyboard, will cause the computer to print out all data entered into or evaluated by the computer for each zone.

54. After all of the met messages are printed out, the LED displays "NEED "LAST FLIGHT" UPDATING?". Pressing the YES key causes the computer to dump the previous flight and place this flight into memory. Pressing the NO key causes the LED to display "PROCESSING FLIGHT CONTINUATION" and the computer automatically takes you back to "EVALUATE SIGNIFICANT LEVEL #17", "ENTER PRESS CONTACT (54.2)". The logic behind this is very simple. Suppose someone only wants a 5-line message. Instead of making him wait until the flight was completed, you could output the required messages by pressing the NO key and then the OUTPUT key when the LED displayed OK FOR MESSAGES TO HEIGHT 2000. If only the computer and ballistic type 3 messages were required, you could delete the other messages when the LED displayed that they were being processed by using the DELETE key. For all flights in this reference note, use the NO key.

55. You have completed flight #1 and have a hard copy of the messages. Now eject the tape and shut off the computer. Work the second and third flights for more practice. Use the linearity calibration chart, the pressure calibration chart and the angular data from flilght #1 for both of the remaining flights. To start the next flight insert the tape, turn on the computer, and begin.

56. For other capabilities of the OL-192 in the processing of met data, refer to TM 11-6660-263-10, Meteorological Data Groups OL-192/GMD-1 and OL-192A/GMD-1.

OCTANT 1

BALLISTIC DENSITY FROM SURFACE DATA

(FM 6-15)

STATION	LOCATION		RELEASE TIME		DATE	HOUR	FLIGHT NO.
MET	34.7	98.3		LST	28 JUNE 87	0900	1
				GMT	28 JUNE 87	1500	

1 (8) TYPE MESSAGE: BALLISTICS [X] A

(1) SURFACE PRESSURE: INCHES; MILLIBARS 1004.3; MSL % STD (ICAO)

2 (9) REGION: 1 [X] 2 3 4 5 6 7

SKY CLEAR

(2) DRY 9.5 °C

(3) WET 5.8 °C

3 (10) PERIOD: NIGHT [ ] AFTERNOON [X] TRANSITION

TEMPERATURE

(4) DEPRESSION °C

(11) TRUE SURFACE DENSITY

(5) VIRTUAL °C %STD

(12) MEAN SURFACE DENSITY: 96.6

(6) STATION HEIGHT (10's meters): 036

4 (13) DEPARTURE FROM MEAN SURFACE DENSITY

(7) SUNRISE: 0523 SUNSET: 1951

LINES	DEPARTURE FROM MEAN BALLISTIC DENSITY (14)	BALLISTIC DENSITY % (15)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

COMPUTATIONS

OBSERVER | COMPUTER | CHECKER

WIND COMPUTATION (ELECTRONIC OR VISUAL)

For use of this form, see FM 6-15; the proponent agency is the US Army Training and Doctrine Command.

STATION	LOCATION	RELEASE TIME		DATE	HOUR	FLIGHT NO.
MET	34.7 98.3		LST	28 Jun 1985	0900	1
			GMT	28 Jun 1985	1500	

ZONE NO	TIME AT TOP OF ZONE (minutes & seconds) (1)		ZONE HEIGHT (meters)	PRESSURE AT TOP OF ZONE	TIME AT TOP OF ZONE	ELEVATION ANGLE (degrees & tenths)	AZIMUTH ANGLE (degrees & tenths)	HORIZONTAL DISTANCE (meters)	HORIZONTAL TRAVEL IN ZONE (meters)	TIME IN ZONE (minutes & tenths)	ZONE WIND DATA		BALLISTIC DATA	
	30 GRAM BALLOON	100 GRAM BALLOON	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	AZIMUTH (10 mils) (10)	SPEED (knots) (11)	AZIMUTH (100 mils) (12)	SPEED (knots) (13)
OFF SET			SUR				31.0	100			SUR 210	SUR 07	SUR	SUR
1	0:54	0:36	200		0.6	25.7	34.3							
2	2:24	1:24	500		1.4	29.4	29.2							
3	5:00	2:54	1000		2.9	34.7	21.4							
4	7:42	4:24	1500		4.4	39.2	17.3							
5	10:24	5:48	2000		5.8	47.3	11.8							
6	15:42	8:54	3000		8.9	47.3	08.4							
7	21:00	12:00	4000		12.0	44.9	02.3							
8	26:18	15:18	5000		15.3	39.5	358.3							
9	31:36	18:48	6000		18.8	33.1	351.6							
10	42:24	25:36	8000		25.6	29.8	348.9							
11	53:12	32:24	10000		32.4	26.7	344.6							
12	64:00	39:12	12000		39.2	24.4	342.8							
13		46:00												
14		52:48												
15		59:36												
16														

ELECTRONIC	MESSAGE TYPE (CHECK ONE) (14)			THEODOLITE OPERATOR	ZONE WIND PLOTTER	BALLISTIC WIND PLOTTER
	BALLISTIC		FALLOUT			
VISUAL	S	A	COMPUTER	TIMER-RECORDER	ZONE WIND COMPUTER	TEAM CHIEF

DA FORM 4469
1 AUG 78

Edition of Dec 75 is obsolete

OCTANT 2

BALLISTIC DENSITY FROM SURFACE DATA

(FM 6-15)

STATION	LOCATION		RELEASE TIME		DATE	HOUR	FLIGHT NO.
MET	40.6	127.5		K			
				LST	9 NOV 1987	1015	2
				GMT	9 NOV 1987	0215	

1 (8) TYPE MESSAGE: BALLISTICS — S [X]

(1) SURFACE PRESSURE: INCHES — MILLIBARS: 987.4 — MSL % STD *(ICAO)*

2 (9) REGION: [X] 1 — 2 — 3 — 4 — 5 — 6 — 7

OVC
RAIN

(2) DRY: 5.3°C

(3) WET: 4.8°C

3 (10) PERIOD: NIGHT — AFTERNOON — [X] TRANSITION

TEMPERATURE

(4) DEPRESSION: °C

(11) TRUE SURFACE DENSITY

(5) VIRTUAL: °C %STD

(12) MEAN SURFACE DENSITY: 95.6

(6) STATION HEIGHT *(10's meters)*: 047

4 (13) DEPARTURE FROM MEAN SURFACE DENSITY

(7) SUNRISE: 0701 SUNSET: 1733

LINES	DEPARTURE FROM MEAN BALLISTIC DENSITY (14)	BALLISTIC DENSITY % (15)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

COMPUTATIONS

OBSERVER | COMPUTER | CHECKER

DA FORM 1 JUN 76 4524

Replaces DA Form 6-50, Mar 62, which will be used.

WIND COMPUTATION (ELECTRONIC OR VISUAL)

For use of this form, see FM 6-15; the proponent agency is the US Army Training and Doctrine Command.

STATION	LOCATION		RELEASE TIME	DATE	HOUR	FLIGHT NO.
MET	40.6	127.5	LST	9 Nov 1985	1015	2
			GMT	9 Nov 1985	0215	

ZONE NO.	TIME AT TOP OF ZONE (minutes & seconds) (1)		ZONE HEIGHT (meters)	PRESSURE AT TOP OF ZONE	TIME AT TOP OF ZONE	ELEVATION ANGLE (degrees & tenths)	AZIMUTH ANGLE (degrees & tenths)	HORIZONTAL DISTANCE (meters)	HORIZONTAL TRAVEL IN ZONE (meters)	TIME IN ZONE (minutes & tenths)	ZONE WIND DATA		BALLISTIC DATA	
	30 GRAM BALLOON	100 GRAM BALLOON									AZIMUTH (10 mils) (10)	SPEED (knots) (11)	AZIMUTH (100 mils) (12)	SPEED (knots) (13)
OFF SET			SUR				310.0	50			SUR 130	SUR 08	SUR	SUR
1	0:54	0:36	200		0.6	29.3	322.8							
2	2:24	1:24	500		1.4	32.7	327.4							
3	5:00	2:54	1000		2.9	36.4	331.7							
4	7:42	4:24	1500		4.4	39.9	339.5							
5	10:24	5:48	2000		5.8	42.3	344.1							
6	15:42	8:54	3000		8.9	47.8	351.2							
7	21:00	12:00	4000		12.0	45.6	001.8							
8	26:18	15:18												
9	31:36	18:48												
10	42:24	25:36												
11	53:12	32:24												
12	64:00	39:12												
13		46:00												
14		52:48												
15		59:36												
16														

ELECTRONIC	MESSAGE TYPE (CHECK ONE) (14)			THEODOLITE OPERATOR	ZONE WIND PLOTTER	BALLISTIC WIND PLOTTER
	BALLISTIC		FALLOUT			
VISUAL	S	A	COMPUTER	TIMER RECORDER	ZONE WIND COMPUTER	TEAM CHIEF

DA FORM 4469
1 AUG 78

Edition of Dec 75 is obsolete

OCTANT 0

BALLISTIC DENSITY FROM SURFACE DATA

(FM 6-15)

STATION	LOCATION		RELEASE TIME	✓	DATE	HOUR	FLIGHT NO
MET	40.0	97.5		LST	4 JUNE 1987	0530	3
				GMT	4 JUNE 1987	1130	

1 — (8) TYPE MESSAGE: BALLISTICS [X] C [ ] A

(1) SURFACE PRESSURE: INCHES [ ] MILLIBARS 974.8 — MSL % STD (ICAO) [ ]

2 — (9) REGION: 1 [X] 2 3 4 5 6 7

SKY CLEAR

(2) DRY 10.7 °C

(3) WET 9.3 °C

TEMPERATURE

(4) DEPRESSION °C

3 — (10) PERIOD: NIGHT [X] AFTERNOON [ ] TRANSITION [ ]

(5) VIRTUAL °C %STD

(11) TRUE SURFACE DENSITY

(12) MEAN SURFACE DENSITY 95.6

(6) STATION HEIGHT (10's meters) 047

4 — (13) DEPARTURE FROM MEAN SURFACE DENSITY

(7) SUNRISE 0521 SUNSET 1943

LINES	DEPARTURE FROM MEAN BALLISTIC DENSITY (14)	BALLISTIC DENSITY % (15)	COMPUTATIONS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

OBSERVER | COMPUTER | CHECKER

WIND COMPUTATION (ELECTRONIC OR VISUAL)

For use of this form, see FM 6-15: the proponent agency is the US Army Training and Doctrine Command.

STATION	LOCATION		RELEASE TIME	DATE	HOUR	FLIGHT NO.
MET	40.0	97.5	LST	9 JUN 87	0530	3
			GMT	9 JUN 87	1130	

ZONE NO	TIME AT TOP OF ZONE (minutes & seconds) (1)		ZONE HEIGHT (meters)	PRESSURE AT TOP OF ZONE	TIME AT TOP OF ZONE	ELEVATION ANGLE (degrees & tenths)	AZIMUTH ANGLE (degrees & tenths)	HORIZONTAL DISTANCE (meters)	HORIZONTAL TRAVEL IN ZONE (meters)	TIME IN ZONE (minutes & tenths)	ZONE WIND DATA		BALLISTIC DATA	
	30 GRAM BALLOON	100 GRAM BALLOON	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	AZIMUTH (10 mils) (10)	SPEED (knots) (11)	AZIMUTH (100 mils) (12)	SPEED (knots) (13)
OFF SET			SUR				224.0	75			SUR 057	SUR 04	SUR	SUR
1	0:54	0:36	200		.6	43.8	219.7							
2	2:24	1:24	500		1.4	48.3	217.9							
3	5:00	2:54	1000		2.9	44.7	213.4							
4	7:42	4:24	1500		4.4	39.5	207.8							
5	10:24	5:48	2000		5.8	36.6	203.6							
6	15:42	8:54	3000		8.9	31.2	198.7							
7	21:00	12:00	4000		12.0	29.7	196.9							
8	26:18	15:18	5000		15.3	26.4	191.4							
9	31:36	18:48	6000		18.8	24.7	189.7							
10	42:24	25:36	8000		25.6	22.5	186.4							
11	53:12	32:24	10000		32.4	21.9	181.1							
12	64:00	39:12	12000		39.2	19.2	179.3							
13		46:00												
14		52:48												
15		59:36												
16														

ELECTRONIC	MESSAGE TYPE (CHECK ONE) (14)			THEODOLITE OPERATOR	ZONE WIND PLOTTER	BALLISTIC WIND PLOTTER
	BALLISTIC		FALLOUT			
VISUAL	S	A	COMPUTER	TIMER-RECORDER	ZONE WIND COMPUTER	TEAM CHIEF

DA FORM 4469
1 AUG 78

Edition of Dec 75 is obsolete.

RADIOSONDE DATA FOR OL-192

STATION	LOCATION	FLIGHT NO.
FAMCC	347 983	PE 1

PRE-FLIGHT TIME		DATE	HOUR	BAROSWITCH NO.	PRESSURE	CONTACT
	LST	17 MAY 1987	0820	612-1565	977.1	[redacted]
	GMT	17 MAY 1987	1420			

PRE-FLIGHT CIRCUIT CHECK						REF. R.D.	LAUNCH TIME GMT
TEMP	30.0 °C	73.42	R.D.	14042	OHMS	95.0	1440
HUM	33 %	78.18	R.D.	10370	OHMS		

HORIZONTAL OFF-SET		SURFACE WIND		SFC PRESSURE	SFC CONTACT	WMO CODE
AZIMUTH	300.1	DIRECTION	300.1	977.1	7.5	72355
DISTANCE	50.0	SPEED	10.0			

LEVEL NUMBER	CONTACT	TIME	REFERENCE R.D.	TEMP. R.D.	HUM. R.D.
SUR 0	7.5	0.00	95.0	70.6	56.4
1	9.3	0.38	95.0	69.4	42.6
2	10.0	0.60	95.0	69.3	51.0
3	12.4	1.38	95.0	69.8	69.9
4	16.0	2.61	95.1	68.7	63.9
5	18.1	3.46	95.1	67.0	58.0
6	20.5	4.20	95.0*	XXX	XXX
7	24.2	5.31	95.0*	67.0	19.5
8	26.2	6.01	95.0	65.2	9.8
9	26.9	6.10	95.0	64.2	30.0
10	27.4	6.40	95.1	63.7	78.9
11	29.0	6.95	95.1	64.0	81.1
12	32.2	7.99	95.1	62.9	81.0
13	34.3	8.69	95.1	62.3	81.1
14	43.0	11.30	95.1	57.1	80.0
15	45.3	11.97	95.2	55.2	80.3
16	50.0	13.37	95.2	53.2	79.8

RECORDER OPERATOR	COMPUTER OPERATOR	CHECKER

FS Form 230 (TEST)
(TAD) 1 Dec 84

SURVEY DATED: 17 1430Z May 87
OCTANT: 1
LATITUDE: 34.7° LONGITUDE: 98.3
ELEVATION: 360 Meters

RADIOSONDE DATA FOR OL-192

STATION	LOCATION	FLIGHT NO.
FAMCC	347 983	PE 2

PRE-FLIGHT TIME		DATE	HOUR	BAROSWITCH NO.	PRESSURE	CONTACT
	LST	17 May 1987	0910	612-1565	967.4	[redacted]
	GMT	17 May 1987	1510			

PRE-FLIGHT CIRCUIT CHECK						REF. R.D.	LAUNCH TIME GMT
TEMP	30.0 °C	73.72	R.D.	13787	OHMS	95.0	1520
HUM	33 %	78.33	R.D.	10251	OHMS		

HORIZONTAL OFF-SET		SURFACE WIND		SFC PRESSURE	SFC CONTACT	WMO CODE
AZIMUTH	300.1	DIRECTION	300.0	967.4	8.3	72355
DISTANCE	50.0	SPEED	10.0			

LEVEL NUMBER	CONTACT	TIME	REFERENCE R.D.	TEMP. R.D.	HUM. R.D.
SUR 0	8.3	0.00	95.0	73.4	79.4
1	10.0	0.49	95.0	72.2	78.0
2	16.0	2.65	95.0	69.4	70.8
3	18.1	3.34	95.0	68.3	67.4
4	19.0	3.70	95.0	68.0	75.9
5	20.0	3.93	95.0	68.7	75.3
6	21.4	4.23	95.0	70.0	82.1
7	22.0	4.42	95.0*	XXX	XXX
8	29.0	6.60	95.0*	68.2	82.5
9	32.2	7.60	95.0	66.7	82.4
10	40.0	10.01	95.0	61.5	81.1
11	46.0	11.80	95.0	57.1	81.0
12	50.0	12.97	95.0	54.5	81.8
13					
14					
15					
16					

RECORDER OPERATOR	COMPUTER OPERATOR	CHECKER

FS Form 230 (TEST) SURVEY DATED: 11 1856Z May 87
(TAD) 1 Dec 84 OCTANT: 1
LATITUDE: 347 LONGITUDE: 98.3
ELEVATION: 360 Meters

RADIOSONDE DATA FOR OL-192

STATION	LOCATION	FLIGHT NO.
FAMCC	347 983	PE 3

PRE-FLIGHT TIME		DATE	HOUR	BAROSWITCH NO.	PRESSURE	CONTACT
	LST	17 May 1987	0800	612-1565	966.2	[redacted]
	GMT	17 May 1987	1400			

PRE-FLIGHT CIRCUIT CHECK						REF. R.D.	LAUNCH TIME GMT
TEMP	30.0 °C	73.72	R.D.	13787	OHMS	95.0	1415
HUM	33 %	78.33	R.D.	10251	OHMS		

HORIZONTAL OFF-SET		SURFACE WIND		SFC PRESSURE	SFC CONTACT	WMO CODE
AZIMUTH	300.1	DIRECTION	300.0	966.2	8.4	72355
DISTANCE	50.0	SPEED	10.0			

LEVEL NUMBER	CONTACT	TIME	REFERENCE R.D.	TEMP. R.D.	HUM. R.D.
SUR 0	8.4	0.00	95.0	74.2	81.4
1	13.0	1.27	94.8	72.0	80.7
2	18.1	2.53	94.7	69.5	79.8
3	22.0	3.79	94.7	68.0	78.9
4	24.0	4.37	94.7	68.7	79.9
5	32.2	6.83	94.5	65.2	81.6
6	38.0	8.64	94.5	61.7	80.8
7	45.0	11.10	94.3*	XXX	XXX
8	54.1	13.68	94.2*	52.5	81.1
9	64.0	16.66	94.1	45.5	75.4
10	67.3	17.99	94.1	41.7	76.3
11	74.4	19.71	94.1	37.2	75.0
12	82.5	22.23	94.1	28.6	XXX
13	91.4	25.10	94.0	22.5	XXX
14	95.0	26.28	94.0	19.9	XXX
15	98.0	27.29	94.0	18.7	XXX
16					

RECORDER OPERATOR	COMPUTER OPERATOR	CHECKER

FS Form 230 (TEST)
(TAD) 1 Dec 84

SURVEY DATED: 17 1430 May 87
OCTANT: 1
LATITUDE: 34.7 LONGITUDE: 98.3
ELEVATION: 360 Meters

ANGULAR DATA FOR PRACTICAL EXERCISES

EL	TIME	AZ
30.97	8.3	038.24
30.87	8.2	037.92
30.71	8.1	037.40
30.46	7.4	034.48
30.88	7.3	033.88
30.54	7.2	033.41
30.52	7.1	032.32
30.39	7.0	032.40
30.38	6.9	031.89
30.37	6.8	031.51
30.51	6.2	028.25
30.63	6.1	027.77
30.41	6.0	025.66
30.19	5.6	024.83
30.21	5.5	024.16
30.13	5.4	023.43
30.08	5.0	022.15
30.04	4.9	020.02
30.02	4.8	019.19
-		
29.79	4.3	015.97
29.84	4.2	015.33
29.81	4.1	014.79
30.04	3.6	012.49
30.04	3.5	011.91
30.80	3.0	009.41
31.14	2.9	008.97
31.27	2.8	008.21
31.27	2.7	007.55
31.42	2.4	005.80
31.29	2.3	005.35
31.27	2.2	005.15
31.13	2.1	004.62
30.85	2.0	004.16
30.04	1.9	003.73
29.34	1.8	003.39
29.08	1.7	002.67
28.21	1.6	001.73
27.67	1.5	001.22
27.68	1.4	000.17
26.62	1.3	359.47
26.04	1.2	358.17
25.23	1.1	357.13
24.81	1.0	355.02
24.02	0.9	353.36
26.71	0.6	351.58
26.39	0.5	349.94
25.90	0.4	347.15
02.20	0.0	300.05

EL	TIME	AZ
37.65	26.5	093.12
XXX	26.4	XXX
37.53	26.3	092.80
37.47	24.2	087.53
37.41	24.1	087.58
36.95	24.0	085.81
36.71	21.8	081.76
36.71	21.7	081.49
35.89	19.6	074.18
35.86	19.5	073.78
XXX	19.4	XXX
35.72	19.3	072.97
35.63	19.2	072.57
34.33	17.6	067.52
34.25	17.5	067.23
34.16	17.4	066.97
31.43	15.0	061.95
31.30	14.9	061.72
30.70	13.4	057.95
30.69	13.3	057.65
31.46	12.5	055.72
31.52	12.4	055.39
31.55	12.3	055.07
31.64	12.2	054.64
31.63	12.1	054.25
31.66	12.0	053.28
31.73	11.9	053.33
31.33	11.8	053.00
31.75	11.2	050.13
31.57	11.1	049.60
31.61	11.0	049.11
31.78	10.9	048.75
32.25	10.8	048.39
31.62	10.7	048.05
31.78	10.6	047.71
31.53	10.0	045.11
31.32	9.9	044.94
31.58	9.8	044.58
31.48	9.7	044.17
31.64	9.6	043.76
31 39	9.5	043.38
31.54	9.4	042.94
31.61	9.3	042.50
30.89	8.7	039.90
30.88	8.6	039.39
30.94	8.5	038.97
30.88	8.4	038.78

BAROSWITCH PRESSURE CALIBRATION CHART

DATE 17 MAY 84 RELEASE TIME, G.M.T. 1400 SOUNDING NO. PE2-2-3

STATION FAMCG COMPUTED NO. DETENT CLICKS 10

BAROSWITCH SERIAL NO. 612 - 1565 * DETENT CLICK VALUE .55

	1	2	3	4	5	6	7	8	9
	1061.2	1047.6	1035.0	1022.0	1009.0	996.6	983.8	971.4	958.8
10	11	12	13	14	15	16	17	18	19
946.6	934.8	922.6	910.8	899.0	887.4	876.0	864.4	852.8	841.4
20	21	22	23	24	25	26	27	28	29
830.2	819.4	808.2	796.0	785.0	774.2	763.6	752.8	742.4	731.8
30	31	32	33	34	35	36	37	38	39
722.0	711.0	701.6	691.2	681.4	671.2	661.8	652.4	642.4	633.2
40	41	42	43	44	45	46	47	48	49
623.8	614.2	605.4	596.2	587.0	578.2	569.0	560.4	551.8	543.0
50	51	52	53	54	55	56	57	58	59
534.6	526.4	517.8	509.8	501.4	493.4	485.2	477.2	469.4	461.6
60	61	62	63	64	65	66	67	68	69
453.8	446.4	438.8	431.2	423.8	416.6	409.8	402.6	395.6	388.6
70	71	72	73	74	75	76	77	78	79
381.8	374.8	368.0	361.2	354.8	348.2	341.6	335.2	328.6	322.2
80	81	82	83	84	85	86	87	88	89
316.4	310.0	304.0	298.0	291.6	286.2	280.4	274.6	269.0	263.6
90	91	92	93	94	95	96	97	98	99
258.0	252.6	247.0	241.6	236.6	231.2	226.2	220.8	216.2	211.0
100	101	102	103	104	105	106	107	108	109
206.2	201.0	196.6	191.6	187.0	182.2	178.0	173.6	169.0	164.6
110	111	112	113	114	115	116	117	118	119
160.2	156.2	151.8	147.6	143.8	139.8	135.8	131.8	128.0	124.2
120	121	122	123	124	125	126	127	128	129
120.4	116.8	113.2	109.8	106.2	102.8	99.2	96.0	92.8	89.8
130	131	132	133	134	135	136	137	138	139
86.6	83.4	80.2	77.4	74.4	71.4	68.4	65.8	62.8	60.0
140	141	142	143	144	145	146	147	148	149
57.4	54.4	52.0	49.6	46.8	44.4	42.0	39.4	37.0	34.8
150	151	152	153	154	155	156	157	158	159
32.6	30.2	28.0	25.6	23.4	21.0	18.8	16.6	14.4	12.2
160	161	162	163	164	165	166	167	168	169
10.0	7.6	5.4	3.2	.0	.0	.0	.0	.0	.0
170	171	172	173	174	175	176	177	178	179
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

852.8
341.

CONTACT VALUES FOR MANDATORY LEVELS

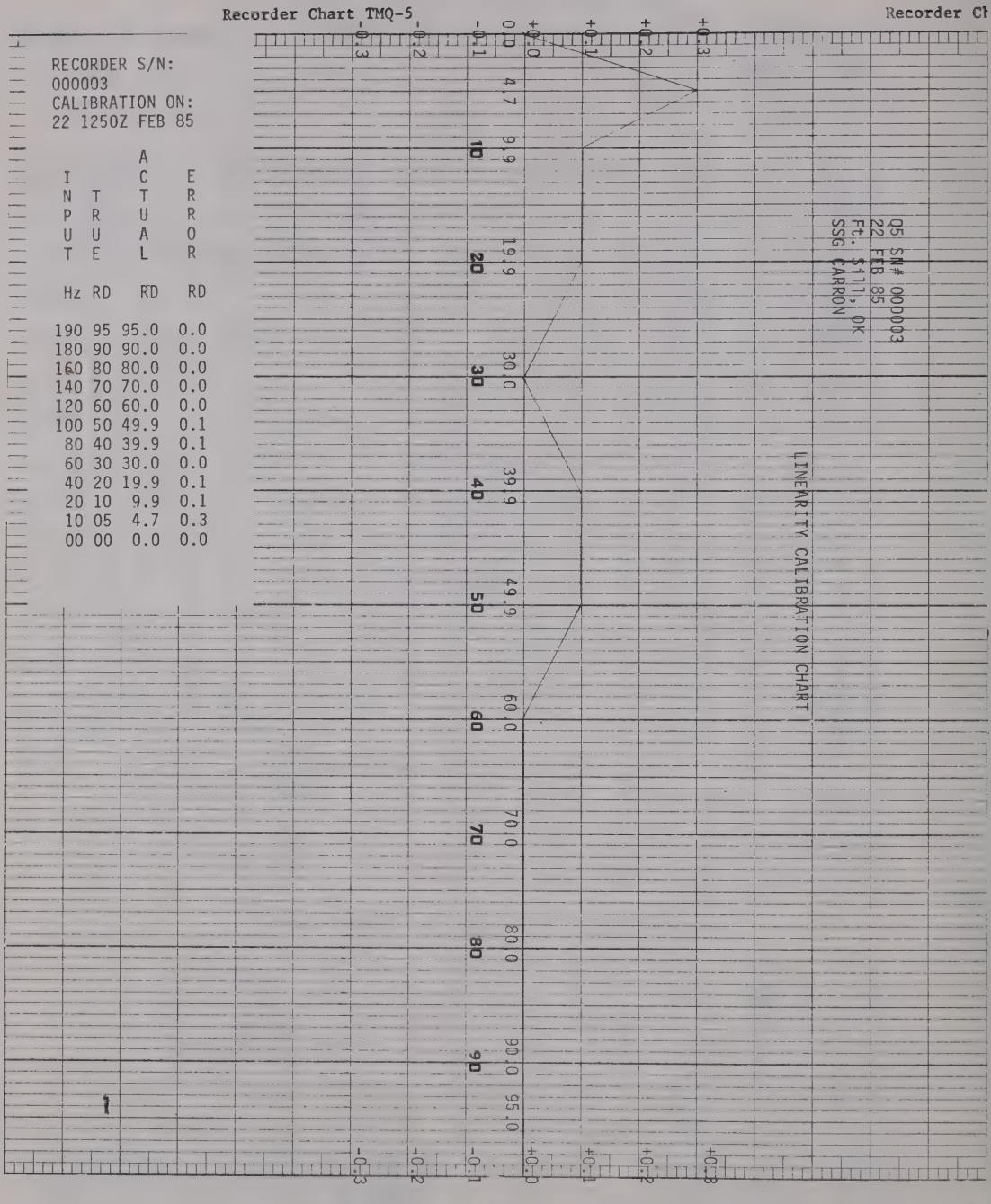
1000	5.72	300	82.66	70	135.46	7	161.27
850	18.24	250	91.46	50	142.83	5	162.18
700	32.15	200	101.22	30	151.09	3	163.09
500	54.17	150	112.42	20	155.45	2	163.54
400	67.37	100	125.77	10	160.00	1	164.00

VIZ MANUFACTURING CO.
335 E. PRICE ST., PHILA PA 19144 215-844 2626

VIZ FORM NO. 1292-168
7/81 — 175M

0000 0000 0000 0001 21106 09042

Recorder Chart TMQ-5



Chapter 3
Service

Introduction

This chapter contains a brief Block Diagram Description, Troubleshooting and Repair information, and a Theory of Operation section. This information will help you service the 98032A Interface.

If you have difficulty repairing the interface or if you would rather have HP repair it, contact the nearest Sales and Service office for assistance; office locations are listed at the back of this manual.

Block Diagram Description

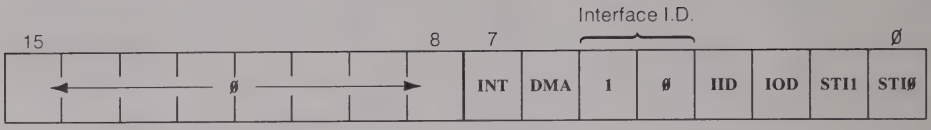
The interface consists of four registers and control circuits. Refer to the block diagram and schematic (Figure 3-1 and 3-4).

Registers

The four registers on the interface are registers 4, 5, 6 and 7.

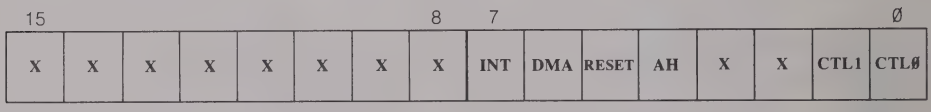
- Register 4 is two 8-bit registers, one for low-byte data-in and one for low-byte data-out.
- Register 6 is two 8-bit registers, one for high-byte data-in and one for high-byte data-out.
- Register 5 (8-bits) is the status "in" register and control "out" register. The bit registers that make up Register 5 are located at various positions on the schematic. To find their locations trace the R5IN and R5SB (U13) lines to the various bit registers. The bit position within Register 5 can be found by following the bit registers input or output to the data bus and noting the data line mnemonic. The bits and their mnemonics for input and output are shown below.

Input from register 5



STIØ = Status bit 0
STI1 = Status bit 1
IOD = Invert Output Data
IID = Invert Input Data
DMA = Direct Memory Access Enable
INT = Interrupt Enable

Output to register 5



CTLØ = Control Bit 0
CTL1 = Control Bit 1
AH = Auto Handshake
RESET = Resets the Interface
DMA = Direct Memory Access
INT = Interrupt Enable
X = Don't care

- Register 7 has no bits and always returns zero, but outputting data to R7 (R7SB) causes control to be set on the PCTL line, beginning a new handshake.

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Program Control of the Registers

Write and Write Binary

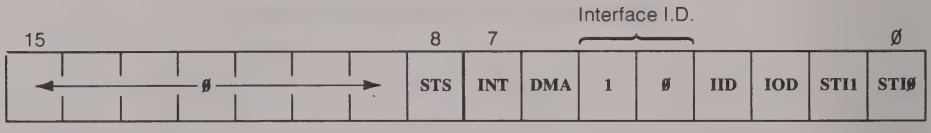
These operations transfer data to the output line in bit-parallel, character-serial fashion. Refer to the appropriate ROM Manual for syntax and operation. Refer to Figure 2-9 for bit assignment.

Read and Read Binary

These operations clock the input data into the input register and then transfer it to the calculator, in bit-parallel, character-serial fashion. Refer to the appropriate ROM Manual for syntax and operation. Refer to Figure 2-7 for bit assignments.

Read Status

This operation transfers, to the calculator, the decimal value of the interface status register. The bit locations and their mnemonics are shown below.



STIØ = Status bit Ø
STI1 = Status bit 1
IOD = Invert Output Data
IID = Invert Input Data
DMA = Direct Memory Access Enable
INT = Interrupt Enable
STS = Status (Peripheral)

When the 9825A Calculator executes a read status statement in reference to the 98032A Interface, it will receive a value representing the lower 9 bits (bits 0 – 8) of the status register.

Write Control

This operation allows you to reset the interface and control the peripheral. Bits 0 and 1 can be used to control a peripheral, via the CTL0 and CTL1 lines, respectively. The bits and their mnemonics are shown below.

Troubleshooting and Repair

The following procedures assume that the calculator, ROM(s) and peripheral device are operating correctly. If necessary, disconnect the interface from the calculator and perform all other applicable test procedures before assuming that the interface is defective.

Broken Trace Repair

If one or more traces are open or have high resistance, the trace should be bridged using insulated wire. Note – the boards are of multi-layer construction, and therefore require good soldering technique to prevent damage.

> **CAUTION**
>
> To help prevent damage to the circuit boards use a low-temperature soldering iron when making repairs or replacing parts.

Recommended Equipment

The following is a list of equipment that will aid in troubleshooting the 98032A 16-Bit Interface:

- An HP 10525A Logic Probe (or equivalent)*
- Appropriate calculator and ROM(s)
- A Test Connector (98241-67932)
- An Extender Board (98241-67901)

For checking most signals within the interface, any general-purpose oscilloscope or logic probe can be used; it should be capable of indicating the presence of TTL level signals with pulse widths greater than 200 ns.

*Any device capable of indicating the state of TTL signals.

Equipment Set Up

To make the following tests or checks it will be necessary to remove the case from the interface circuit boards. To do this, remove the screws from the sides of the interface. Use the Extender Board to reconnect the interface to the calculator.

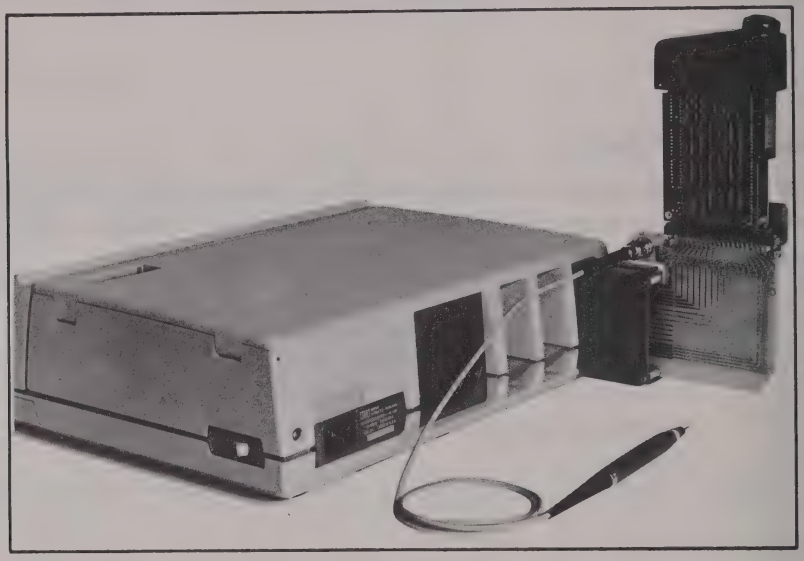


Figure 3-3. Interface Test Set Up

Procedure

The following procedure will help isolate a problem to a defective circuit on the interface. Troubleshoot the circuit by checking the associated components and signals. Refer to the section of the Theory of Operation that describes the defective circuit.

Refer to the schematic and component location for the test points and circuits referred to in the following procedure:

1. Execute a statement to write a binary value (e.g., `wtb 2,0`*) to the interface. Use the logic probe to check the state of the I/O line (P1-31), it should be low.
2. Execute a statement to read binary (e.g., `rdb (2)`*) from the interface, use the logic probe to check the state of the I/O line (P1-31), it should be high.

*9825A General I/O ROM Syntax

3. Repeat steps 1 and 2 but check the PCTL line (P1-32) for a low pulse and the PFLG line (P1-34) for a high pulse, each time a read or write operation is expected.
4. Execute a statement to write binary the value "−1" to the interface (e.g., `wtb2,-1`), use the logic probe to check the state of each of the output data lines, they should all be high. The output data lines can be checked at the collectors of the output transistors (Q20 thru Q35).
5. Repeat the above step, but write binary the value "0" to the interface, recheck the output data lines, this time they should all be low.
6. Execute a read binary statement, the returned value should be equal to the binary data pattern at the output data lines.

Theory of Operation

This section describes in detail the operation of the 98032A 16-Bit Interface, refer to the block diagram and schematic (Figures 3-1 and 3-5). The eight major sections of the schematic and block diagram are:

1. Input Data Register
2. Output Data Register
3. Handshake Logic
4. Control and Status Register
5. Peripheral Address Decoder
6. Register Decoder
7. Interrupt Logic
8. Direct Memory Access (DMA) Logic

Input Data register

The input data register consists of four quad-latches (U22 through U25). The input data lines from the peripheral are connected to resistive dividers (3K ohms to +5V and 6.2K ohms to ground) and the input latches. The terminations cause the input lines to be biased at 3.4 volts. The lower 8-bits go to the low-byte latches while the upper-bits go the high-byte latches. By omitting jumper B (byte mode) the two input latches can be separately controlled. By installing jumper B (word mode) the enable lines are tied together, thus allowing both bytes to be sent to the calculator at the same time. If jumper B is absent, the low byte is received when the calculator reads from I/O register 4 (R4IN) and the high byte is received when the calculator reads from I/O register 6 (R6IN). The output control line (pin 8) on the latches enables

Input Clocks

There are three choices of clocking signals for the input latches of each byte. The input data can be latched each time the register is ready by installing jumper A and C. The other two choices are related to the transition of the PFLG line from the peripheral. Either the ready-to-busy (jumper B and E) or busy-to-ready (jumper D and 9) transition can be selected as the input data clock. The clock inputs are negative-edge triggered.

Output Data Register

The output data register consists of four CMOS quad-latches (U26 through U29) which are controlled as two 8-bit bytes. Data from the calculator bi-directional data lines (IOD0 through IOD15) is always applied to the inputs of the latches.

Output Clocks

The output data is latched on the rising edge of the clock signal (pin 9). The clocking signals (R4SB and R6SB) are generated whenever the calculator outputs to register 4 or register 6. Installing jumper F on the Configuration Board selects the words mode. This ties these two clocks together causing both 8-bit registers to latch new data from the I/O bus whenever either R4SB or R6SB is generated.

Reset

The clear lines (pin 1) on the output latches are tied together at a pull-up resistor (R25-4). There is a space provided on the Data Board (A3) for a diode (CR1) and a jumper (E1) Which when installed presets the outupt lines to low whenever the interface is reset.

Output Line Drivers

The output line drivers(Q20 through Q35) are driven by the output latches. These drivers are NPN-grounded-emitter transistors. They will each sink 40ma without exceeding .4 volts saturation voltage. Each transistor will cut-off when its base is driven low. The maximum safe collector voltage is 30 volts.

Handshake Logic

The Handshake Logic is used to synchronize the data exchange between the peripheral and the calculator. The handshake is initiated by the calculator and terminated by the peripheral. The peripheral may take as little or as much time to respond as it requires (refer to Figures 2-1 and 2-2).

PCTL Line

PCTL is the handshake signal from the calculator to the peripheral. Its active state is control-set. When the interface is RESET (e.g., during power up) the PCTL line state is set to control-clear. The default sense of the PCTL signal is low = control-set and high = control-clear. The sense may be inverted by installing jumper 3.

PFLG Line

PFLG is the handshake line from the peripheral to the calculator. The two states of the PFLG line are busy and ready. The default sense of the PFLG line is low = busy and high = ready. The sense may be inverted by installing jumper 4.

I/O Line

The I/O direction control flip-flop (U14A) controls the I/O line to the peripheral. The flip-flop's state is not affected by RESET and therefore is undetermined at power-up. A write operation will cause the I/O line to go low. A read operation will reset the I/O flip-flop, causing the I/O lines to go high. The I/O line driver (U18B) is an open-collector device capable of sinking 40ma with .7 volt maximum saturation voltage. The I/O line driver can withstand 30 volts maximum.

STS Line

The STS line is examined by the calculator during an I/O operation. When STS is low, it indicates that the addressed interface is OK. If STS is high, there is either no interface addressed or the peripheral is NOT OK. The PSTS line from the peripheral controls the STS signal.

PSTS Line

The PSTS line is received on the Data Board by a TTL Schmitt trigger (U30B). The output of the Schmitt trigger is sent to an exclusive-or-gate (U16B) which controls the logic sense of the PSTS line. The normal sense of the PSTS line is high = OK and low = NOT OK. Installing jumper 5 inverts the logic sense of this line. The calculator will issue an error if it tries an I/O operation and finds PSTS NOT OK.

Output Handshake

When the calculator executes an output operation, data is sent to the output register and the I/O line to the peripheral will go low. After a short delay (100 ns, to allow the data to settle) the PCTL line goes to the control set state. This tells the peripheral that data is available. The peripheral responds by making a ready-to-busy transition on the PFLG line. This will cause the PCTL signal to return to the control clear state. If jumper 6 is installed (pulse mode) the handshake is complete and the peripheral is considered ready for another transfer.

If jumper 6 is not installed (full mode) then the interface will indicate busy until the PFLG line returns to the ready state. In this mode the calculator will not initiate another transfer until the PFLG line returns to the ready state.

Input Handshake

For an input operation, the calculator waits for a low on the I/O bus FLG line, then changes the I/O line to high and the PCTL line to control set. The calculator then waits for the data on the input lines. The peripheral changes PFLG to the busy state, this returns PCTL to the control clear state. If jumper 6 is installed, the calculator will accept the data at this time. Without jumper 6 the calculator will wait until PFLG is returned to the ready state before accepting the data.

Control and Status Register

Interface Control Bits

The Control and Status Register (register 5) consists of a number of flip-flops that control the mode-of-operation of the interface. Auto Handshake, Direct Memory Access (DMA) and Interrupt are enabled by outputing 1's to bits 4, 6, and 7 of register 5, respectively. These modes may be disabled, individually, by outputing 0's to their respective bits. All three modes are disabled by the RESET line (U10B pin 4) going low (e.g., at power-up). The RESET signal is generated in one of two ways:

1. An INIT initialize signal from the calculator I/O bus.
2. Outputting a 1 to bit 5 of register 5.

The calculator pulses INIT low whenever it powers up and when the RESET key is pressed. All interfaces connected to the calculator are sent INIT, whereas , only the currently addressed interface is reset by bit 5 in register 5. The RESET signal is buffered (U13A) and sent to the peripheral as "PRESET."

Peripheral Control Bits

In addition to the control signals already mentioned, there are two peripheral control bits (CTL0 and CTL1 from Q36 and Q37) that can be used to further control the peripheral (e.g., to set special modes).

Interface Status Bits

When the calculator reads register 5, status information about the interface and the peripheral is returned. The upper byte is always zero.

The lower byte gives the state of Interrupt Enable and DMA Enable in bits 7 and 6 respectively. Bits 5 and 4 are interface type-identifier bits; for 98032A Interface they are always 1 and 0 respectively. Bits 3 and 2 are the data inversion bits. If bit 3 equals 1, then jumper 1 is installed, indicating that the input data will be received as positive-true logic. If bit 2 equals 1, then jumper 2 is installed, indicating that the output data will be positive-true logic.

Peripheral Status Bits

Bits 1 and 0 are the extended status bits (STI1 and STI0) from the peripheral. These two bits are latched just before the status is sent to the calculator. The peripheral status input lines do not have invertable logic sense (low = 1).

The Peripheral Address Decoder

The Peripheral Address Decoder circuit (U4A through U4C) compares the peripheral address on the I/O bus to the select-code switch (S1) setting. If these two addresses are equal, the peripheral address decoder output (MYPA) is enabled (high). Without the Configuration Board installed MYPA is disabled by U18E. The peripheral address lines are, like all I/O bus lines, negative true. When MYPA is high, the interface can take control of the FLG and STS lines on the I/O bus.

Register Decoder

MYPA is AND'd (U2A) with not-INT (no interrupt poll in progress) signal, this composite signal enables the Register Decoder (U13). The eight open-collector outputs of this decoder are the I/O register control signals. The I/O bus signal DOUT determines the direction of the transfer. The I/O bus signals IC1 and IC2 determine which register is being addressed. The following table relates the decoder output line mnemonics to its input lines.

Table 3-1. Register Decoder

Calculator I/O Bus Lines				Decoder Output Line
IC1	IC2	DOUT	IOSB	Mnemonic
0	0	0	X	R4IN
0	1	0	X	R5IN
1	0	0	X	R6IN
1	1	0	X	R7IN
0	0	1	1	R4SB
0	1	1	1	R5SB
1	0	1	1	R6SB
1	1	1	1	R7SB

0 = low, 1= high, X = don't care

The Register Decoder output lines are normally high. Four of these signals (R4IN through R7IN) are used to control the input operations and the other four signals (R4SB through R6SB) are used to strobe (clock) the output data. During an interrupt poll the register decoder is disabled by INT.

Interrupt Logic

The Interrupt logic is enabled and disabled by bit 7 of register 5. When interrupt is enabled (bit 7 equals 1) the select-code switch setting determines which level of priority and which poll response bit the interface will use. The high-level interrupt (high priority) is used by devices with select codes 8 through 15. The low-level interrupt (low priority) is used by interfaces with select codes 0 through 7.

Poll Response

The lower three bits from the select-code switch are used as the inputs to a three-to-eight line decoder (U1). The open-collector outputs of the decoder are connected to the IOD0 through IOD7 lines. If the interrupt mode is set and the previous handshake is complete (I/O Bus FLAG – low, PFLG – Ready) the interface will request an interrupt. If the interrupt is set and a handshake is in progress (I/O Bus FLAG – high, PFLG – Busy) the peripheral will cause an interrupt when it completes the handshake (PFLG – Ready). This causes the interface to ground either IRL or IRH as determined by P3 of the select-code switch. These interrupt request lines are Wire-Or'd on the I/O bus. This allows more than one interface to simultaneously request interrupt service on the same interrupt level. When an interrupt request is received by the calculator and the interrupt system is active, the calculator does an interrupt poll. To initiate a poll the calculator grounds the INT line, then each device requesting service will respond in the following manner. During a low-level poll interfaces on select-codes 0 through 7 that are requesting service will ground the bit corresponding to its select code value. Interfaces 8 through 15 that are requesting service will respond to a high-level poll by grounding the bit corresponding to their select-code value minus eight. For example, an interface set to select-code 9 will ground bit 1 (9–8 = 1) during a high-level poll if it is requesting service. Only those interfaces enabled for interrupt and actively requesting service on IRL or IRH will respond to a poll.

Before an interface actively requests service, it will first check to see if a interrupt poll is already in progress. If a poll is in progress it will wait until INT returns to high. This is accomplished with the Interrupt-active flip-flop (U5A) and an AND gate (U2B). The interrupt request logic sets the Interrupt-active flip-flop when interrupt enable (bit 7 of register 5) is set, Direct Memory Access (DMA) is disabled and FLAG is high, or when External Interrupt Request (EIR) is low.

Direct Memory Access Logic

To enable the interface for Direct Memory Access (DMA) transfer, the calculator will set the DMA enable flip-flop (U11A) and the Auto Handshake enable flip-flop (U14B). In the DMA mode, a DMA transfer is requested when FLAG is high. Interrupt requests are blocked by U7A when DMA enable is set. Interrupt may be requested when DMA is enabled but it will not be processed until the DMA transfer is complete. The DMAR I/O bus signal is used to initiate a DMA transfer. This signal is connected to the calculator through jumper 7. The DMA enable flip-flop is reset by RESET and by any I/O transfer to R6 or R7. When DMA terminates on the last word transferred, the DMA enable is cleared automatically. This will cause the interface to request service at the end of a DMA transfer if interrupt enable is set. Grounding the EIR line will terminate a DMA transfer that is in progress.

DMAR is released very quickly after the DMA I/O cycle begins in order to avoid extraneous DMA requests.

Logic Symbols

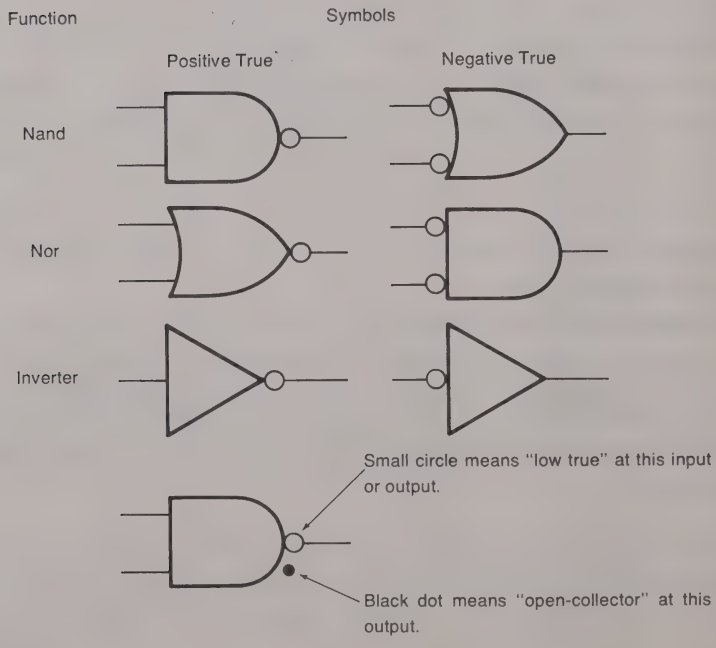
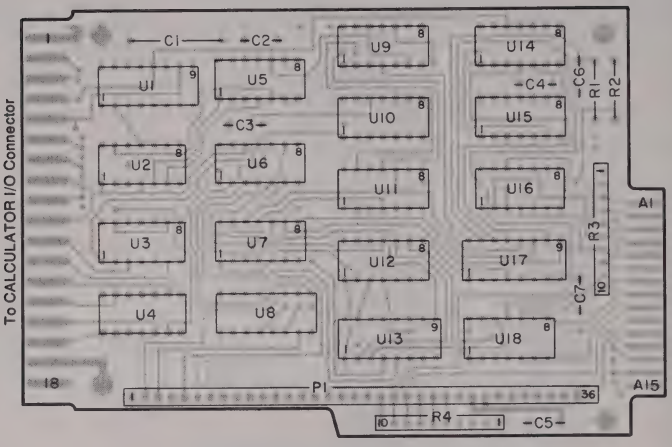


Table 3-2. Replaceable Parts

	REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
	A1	**98032-66501**			**Control Assembly**		
	C1	0180-0106			C: Fxd, 60UF 6V		
	C2 - C5	0160-4084			C: Fxd, .1UF 50V		
	C6	0140-0149			C: Fxd, 470PF 300V		
	C7	0140-0206			C: Fxd, 270PF 300V		
	P1	1251-4226			Conn. 36 Pin		
	R1, R2	0757-0442			R: Fxd, 10k, 1% l/8W		
	R3, R4	1810-0136			R: Fxd - Network		
	U1, U13	1820-1427			IC: 74LS156N		
	U2, U15	1820-1197			IC: 74S00N		
	U3	1820-1198			IC: 74L03N		
	U4	1820-1297			IC: 74S266N		
	U5,U11,U14	1820-1112			IC: 74LS74N		
	U6	1820-1144			IC: 74LS02N		
	U7	1820-1201			IC: 74LS08N		
	U8	1820-1491			IC: 74LS367N		
	U9	1820-1203			IC: 74LS11N		
	U10	1820-1199			IC: 74S04N		
	U12	1820-1208			IC: 74LS32N		
	U16	1820-1211			IC: 74LS86N		
	U17	1820-1423			IC: 74LS123N		
	U18	1820-0471			IC: 7406N		
	A2	**98032-66502**			**Configuration Assembly**		
	S1	3100-3364			Switch, Hex		
	XA1	1251-4148			Conn. 2 × 15 Pin		
	A3	**98032-66503**			**Data Assembly**		
	C1 - C20	–			Not Assigned		
	C21	0160-4084			C: Fxd .1UF 50V		
	C23 - C25	0160-4084			C: Fxd .1UF 50V		
	C22	0180-0106			C: Fxd 60UF 6V		
	Q1 - Q19	–			Not Assigned		
	Q20 - Q37	1854-0215			XSTR: 2N3904		
	R1 - R20	–			Not Assigned		
	R21, R22	0698-4460			R: Fxd 649 Ohms 1%		
	R23, R24	0757-0274			R: Fxd 1210 Ohms 1%		
	R25,R28,R29	1810-0136			R: Fxd Network		
	R26, R27	1810-0037			R: Fxd Network		
	U1 - U20	–			Not Assigned		
	U21	1820-1411			IC: 74S75		
	U22 - U25	1820-1296			IC: 74S295A		
	U26 - U29	1820-1562			IC: 74C175N		
	U30	1820-1416			IC: 74LS14N		
		98032-31000			**Rear Housing (Standard)**		
		5040-7803			Case - left		
		5040-7804			Case - right		
		98032-61601			Molded Cable & Conn. (std)		
		5040-7860			Molded Cable		
		1251-4147			Conn. 2 × 25 Pin		
		0590-0663			Nut lock 4-40		
		2200-0510			Screw, Front Housing 4-40		
		–			**Front Housing**		
		5040-7801			Case - left		
		5040-7802			Case - right		
		1480-0292			Pin - Dwl .0625		
		5040-7836			Spring - latch		
		2200-0536			Screw 4-40		
		7120-4785			Name Plate (std)		
					Miscellaneous		
		98241-67932			Test Connector		
		98241-67901			Extender Board		

Component Locators

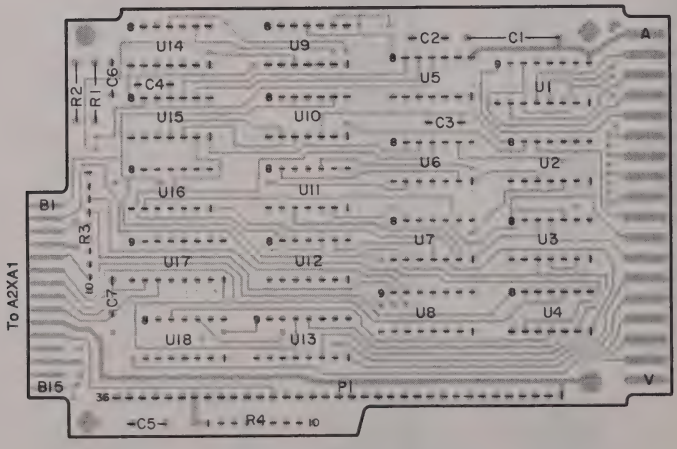


98032A-L-50772

COMPONENT SIDE

A1

-hp- Part No. 98032—66501 Rev A



CIRCUIT SIDE

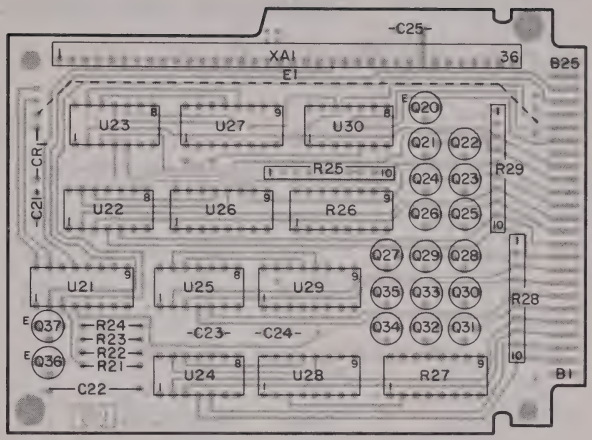
A1

-hp- Part No. 98032—66501 Rev A

COMPONENT SIDE

A2

-hp- Part No. 98032-66502 Rev A



COMPONENT SIDE

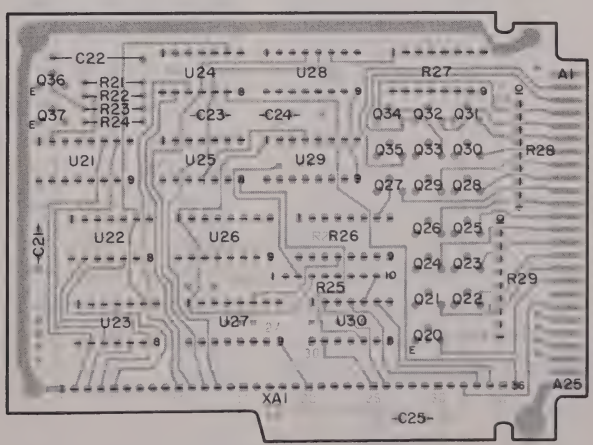
A3

-hp- Part No. 98032-66503 Rev A2

CIRCUIT SIDE

A2

-hp- Part No. 98032-66502 Rev A



CIRCUIT SIDE

A3

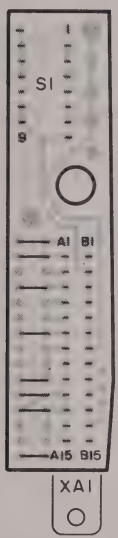
-hp- Part No. 98032-66503 Rev A2

Standard Interface Cable

WIRE COLOR	SIGNAL	A	B	SIGNAL	WIRE COLOR
WH-BK-GN	GND	1	1	GND	WH-BK-BU
WH-YL-GY	DO15	2	2	DI15	WH-RD-BU
WH-YL-VIO	DO14	3	3	DI14	WH-RD-GN
WH-YL-BU	DO13	4	4	DI13	WH-RD-YL
WH-YL-GN	DO12	5	5	DI12	WH-RD-OR
WH-OR-VIO	DO11	6	6	DI11	WH-BN-GN
WH-OR-BU	DO10	7	7	DI10	WH-BN-YL
WH-OR-GN	DO9	8	8	DI9	WH-BN-OR
WH-OR-YL	DO8	9	9	DI8	WH-BN-RD
WH-VIO	DO7	10	10	DI7	VIO
WH-BU	DO6	11	11	DI6	BLU
WH-GN	DO5	12	12	DI5	GRN
WH-YL	DO4	13	13	DI4	YEL
WH-OR	DO3	14	14	DI3	ORG
WH-RD	DO2	15	15	DI2	RED
WH-BN	DO1	16	16	DI1	BRN
WH-BK	DO0	17	17	DI0	BLK
WHT	GND	18	18	DRAIN	(INNER BARE WIRE)
WH-GY	PCTL	19	19	PFLG	GRY
WH-BK-BN	I/O	20	20	PSTS	WH-BK-GY
WH-BK-RD	PRESET	21	21	EIR	WH-BN-GY
WH-RD-VIO	CTL0	22	22	STI0	WH-BN-BU
WH-RD-GY	CTL1	23	23	STI1	WH-BN-VIO
WH-BK-OR	GND	24	24	GND	WH-BK-YL
(OUTER BARE WIRE)	DRAIN	25	25	NC	

Appendix A
Test Connector

98032A-L-50772



Circuit Side

Test Connector Configuration Jumpers

Test Connector Input/Output Jumpers

SIGNAL	A	B	SIGNAL
GND	1	1	GND
DO15	2	2	DI15
DO14	3	3	DI14
DO13	4	4	DI13
DO12	5	5	DI12
DO11	6	6	DI11
DO10	7	7	DI10
DO9	8	8	DI9
DO8	9	9	DI8
DO7	10	10	DI7
DO6	11	11	DI6
DO5	12	12	DI5
DO4	13	13	DI4
DO3	14	14	DI3
DO2	15	15	DI2
DO1	16	16	DI1
DO0	17	17	DI0
GND	18	18	DRAIN
PCTL	19	19	PFLG
I/O	20	20	PSTS
PRESET	21	21	EIR
CTL0	22	22	STI0
CTL1	23	23	STI1
GND	24	24	GND
DRAIN	25	25	NC

Appendix B
Test Program

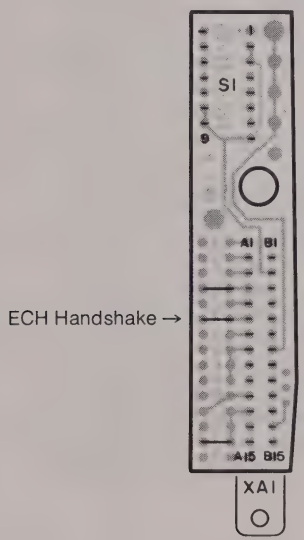
The following 9825A Calculator Interface Test Program can be used to test the operation of the 98032A Interface. This program requires the use of the General I/O ROM.

```
0: prt "98032A
 TEST";spc 2
1: 0→C
2: "t1":
3: dsp "Doing
 DATA PATTERNS
 TEST"
4: -32768+int(rn
 d(1)2*32767)→X
5: wtb 2,X;rdb(2
 )→Y:if X#Y;prt
 "ERROR","Correc
 t",X,"incorrect
 ",Y;spc 2;stp
6: if C/100=int(
 C/100);beep
7: if (C+1→C)<10
 00;gto "t1"
8: 0→C
9: "t3":
10: dsp "Doing
 EXTENDED CTRL
 and STATUS"
11: int(rnd(1)*
 3)→X
12: wtc 2,X;rds(
 2)mod4→Y;if
 X=Y;jmp 2
13: prt "ERROR",
 "Correct",X,
 "incorrect",Y;
 spc 2;stp
14: if C/100=int
 (C/100);beep
15: if (C+1→C)<1
 000;gto "t3"
16: prt "TEST
 COMPLETE";spc
 2;dsp "Test of
 98032 COMPLETE!
 ";stp ;gto 0
17: end
*8538
```

Appendix C

Jumpers to Simulate HP 11202A

To simulate the HP 11202A Interface operation (interface used with HP 9830, 9821, 9820, and 9810 Calculators) install configuration jumpers 4 and E on the 98032A. If ECH handshake is to be simulated, also install configuration jumper 6.



Circuit Side

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APPENDIX D

REFERENCES

Following is a list of publications which are applicable and available to the technician of the Meteorological Data Processing Groups OL-192/GMD-1 and OL-192A/GMD-1.

DA Pam 310-4	Index of Technical Publications: Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins and Lubrication Orders.
DA Pam 310-7	US Army Index of Modification Work Orders.
TM 11-6660-263-10	Operator's Manuals for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 11-6660-263-20P	Organizational Repair Parts and Special Tools List for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 11-6660-263-24-1	Organizational, Direct Support, and General Support Maintenance Manual for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 11-6660-263-24-2	Organizational, Direct Support, and General Support Maintenance Manual for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466) (HP Calculator 9825A) (NSN 7420-01-026-2686).
TM 11-6660-263-24-3	Organizational, Direct Support, and General Support Maintenance Manual for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466), Reader-Perforator RP-263/GMD-1 (NSN 6660-01-068-8642) (Remex RAB 6122).
TM 11-6660-263-34P	Direct Support and General Support Repair Parts and Special Tools List for Meteorological Data Processing Groups OL-192/GMD-1 (NSN 6660-01-065-4467) and OL-192A/GMD-1 (NSN 6660-01-065-4466).
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX E

CX-13096/U WIRE RUN LIST

(98032A Opt A03)

(98032 Connector)

Output sig	*Wire code*	*Pin A*	*Pin B*	*Wire code*	*Input sig*
GND	Wh-Bk-Gn	1	1	Wh-Bk-Bu	GND
$\overline{D015}$		2	2		$\overline{D115}$
$\overline{D014}$		3	3		$\overline{D114}$
$\overline{D013}$		4	4		$\overline{D113}$
$\overline{D012}$		5	5		$\overline{D112}$
$\overline{D011}$		6	6		$\overline{D111}$
$\overline{D010}$		7	7		$\overline{D110}$
$\overline{D009}$		8	8		$\overline{D109}$
$\overline{D008}$		9	9		$\overline{D108}$
$\overline{D007}$	Wh-Vio	10	10	Vio	$\overline{D107}$
$\overline{D006}$	Wh-Bu	11	11	Blu	$\overline{D106}$
$\overline{D005}$	Wh-Gn	12	12	Grn	$\overline{D105}$
$\overline{D004}$	Wh-Yl	13	13	Yel	$\overline{D104}$
$\overline{D003}$	Wh-Gr	14	14	Org	$\overline{D103}$
$\overline{D002}$	Wh-Rd	15	15	Red	$\overline{D102}$
$\overline{D001}$	Wh-Bn	16	16	Brn	$\overline{D101}$
$\overline{D000}$	Wh-Bk	17	17	Blk	$\overline{D100}$
GND	Wh	18	18	Drain (Inner bare)	
$\overline{PCTL}$	Wh-Gy	19	19	Gy	$\overline{PILG}$
I/C		20	20	Wh-Bk-Gy	$\overline{PSTS}$
PRESET		21	21		$\overline{EIR}$
CTL0	Wh-Rd-Vio	22	22	Wh-Bn-Bu	$\overline{ST10}$
CTL1	Wh-Rd-Gy	23	23	Wh-Vn-Vio	$\overline{STIL}$
GND	Wh-Bk-Or	24	24	Wh-Bl-Yel	GND
CHASSIS		25	25		CHASSIS

WIRE RUN LIST REMEX PLUGS FROM 98032

Pin No.	DB-25S (To J2) Wire Code	Signal	DB-25P (To J1) Wire Code	Signal
1	Blk	$\overline{D100}$	Wht-Bk	$\overline{D000}$
2	Brn	$\overline{D101}$	Wht-Brn	$\overline{D001}$
3	Red	$\overline{D102}$	Wht-Red	$\overline{D002}$
4	Orn	$\overline{D103}$	Wht-Orn	$\overline{D003}$
5	Yel	$\overline{D104}$	Wht-Yel	$\overline{D004}$
6	Grn	$\overline{D105}$	Wht-Grn	$\overline{D005}$
7	Blu	$\overline{D106}$	Wht-Blu	$\overline{D006}$
8	Vio	$\overline{D107}$	Wht-Vio	$\overline{D007}$
9	Wht-Yel-Blu	PFLG		
10				
11			Wht-Gra	$\overline{PCTL}$
			*Wht-Orn-Yel	
12			Gra	$\overline{PFLG}$
			*Wht-Yel-Blu	
13	Drain (Inner)		Wht-Blk-Grn	$\overline{PSTS}$
	Wht-Blk-Yel	GND		
	Wht-Blk-Blu	GND		
	*Wht-Yel-Grn			
14	Wht-Brn-Vio	$\overline{STIL}$	Wht	GND
			*Jumpers	
15	Wht-Red-Grn	$\overline{CTL1}$	*Jumpers -2	GND
16	*Wht-Orn-Yel	$\overline{PCTL}$		
17				
18			Wht-Blk-Orn	GND
			Wht-Blk-Grn	GND
			Jumper	
19			Wht-Red-Vio	$\overline{CTL0}$
20			Wht-Brn-Blu	$\overline{ST10}$
21				
22				
23			*Wht-Yel-Grn	GND
24				
25				

*Marks added wires. Jumpers connect pins 14, 15, and 18 on DB-25P.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)
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Stateside Army Depot
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Stateside, N.J. 07703

DATE 10 July 1975

PUBLICATION NUMBER	DATE	TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/MPQ-76

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of [illegible] knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. + 24 VDC is the input voltage.

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:
SSG I. M. DeSpiritof 999-1776	SSG I. M. DeSpiritof

DA FORM 1 AUG 74 2028-2

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TM 11-6660-263-24-4		Meteorological Data Processing Groups OL-192/GMD-1 and OL-192A/GMD-1

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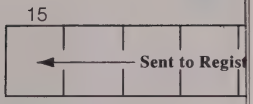


CTLØ = Control Bit Ø
CTL1 = Control Bit 1
RESET = Resets the Int
X = Don't Care

Control Circuits

The control circuits cor
interrupt logic, DMA log

Peripheral Address Dec

The peripheral address
the select-code switch;

I/O Register Decoder

The I/O register decode
transfer and the registe
generated.

Interrupt Logic

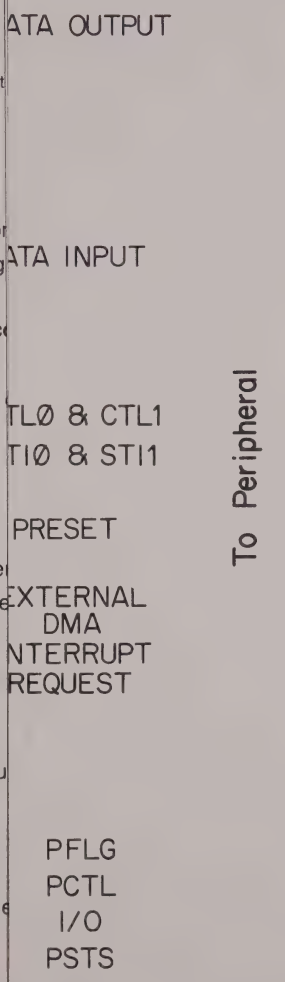
The Interrupt logic circu

DMA Logic

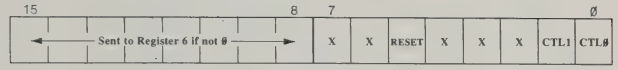
The Direct Memory Acce
the calculator memory.

Handshake Logic

The handshake logic ci
line. Refer to Data Hand



igure 3-1. Block Diagram



CTLØ = Control Bit Ø
CTL1 = Control Bit 1
RESET = Resets the Interface
X = Don't Care

Control Circuits

The control circuits consist of the select-code switch and decoder, I/O register decoder, interrupt logic, DMA logic and the handshake logic.

Peripheral Address Decoder

The peripheral address decoder compares the I/O Bus address from the calculator with that of the select-code switch; a true output (MYPA) is generated when the address matches.

I/O Register Decoder

The I/O register decoder circuit decodes instructions from the calculator. Both the direction of transfer and the register selection are decoded, then an input (IN) or strobe (SB) signal is generated.

Interrupt Logic

The Interrupt logic circuit checks the peripheral to see if it requires service.

DMA Logic

The Direct Memory Access (DMA) logic circuit allows data to be transferred directly to or from the calculator memory.

Handshake Logic

The handshake logic circuit synchronizes the input-output transfer, via the PCTL and PFLG line. Refer to Data Handshake in Chapter 2.

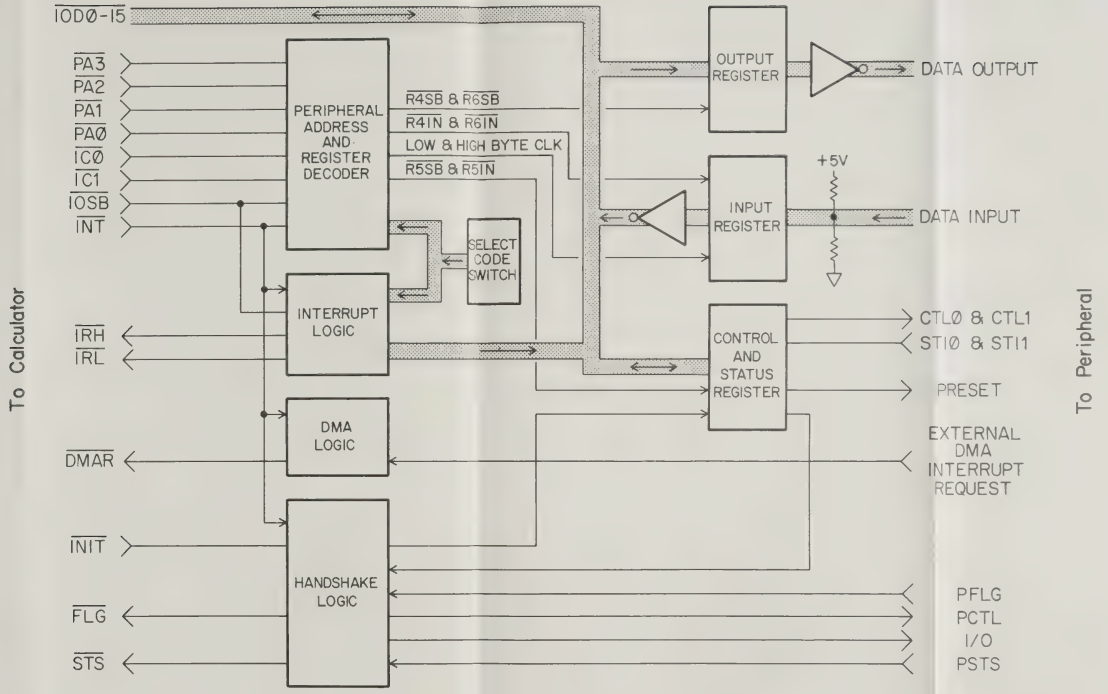


Figure 3-1. Block Diagram

Interface Operational Test

The interface can be checked for proper operation by removing the rear housing and installing the optional test connector (P/N 98241-67932) and then running an interface test program. An example test program that can be used with the 9825A Calculator is given in the Appendix.

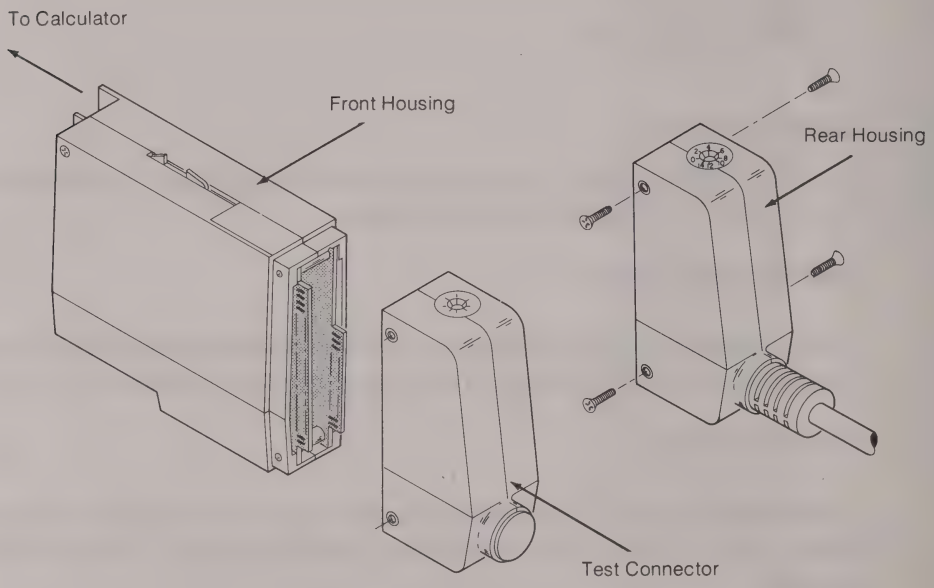


Figure 3-2. Test Connector Installation

The test connector connects the output data lines to the input data lines. This will allow you to write to the interface and then read the same data back into the calculator.

The control output lines are connected to the status input lines to allow a similar write/read test of these lines. PCTL and PFLG are connected together to allow the test connector to operate as a peripheral with handshake.

If the interface operates properly with the test connector but fails to operate the peripheral, recheck the peripheral and refer to information concerning peripherals installation and operation.

If the interface fails to operate properly with the test connector, refer to the next section of this chapter.

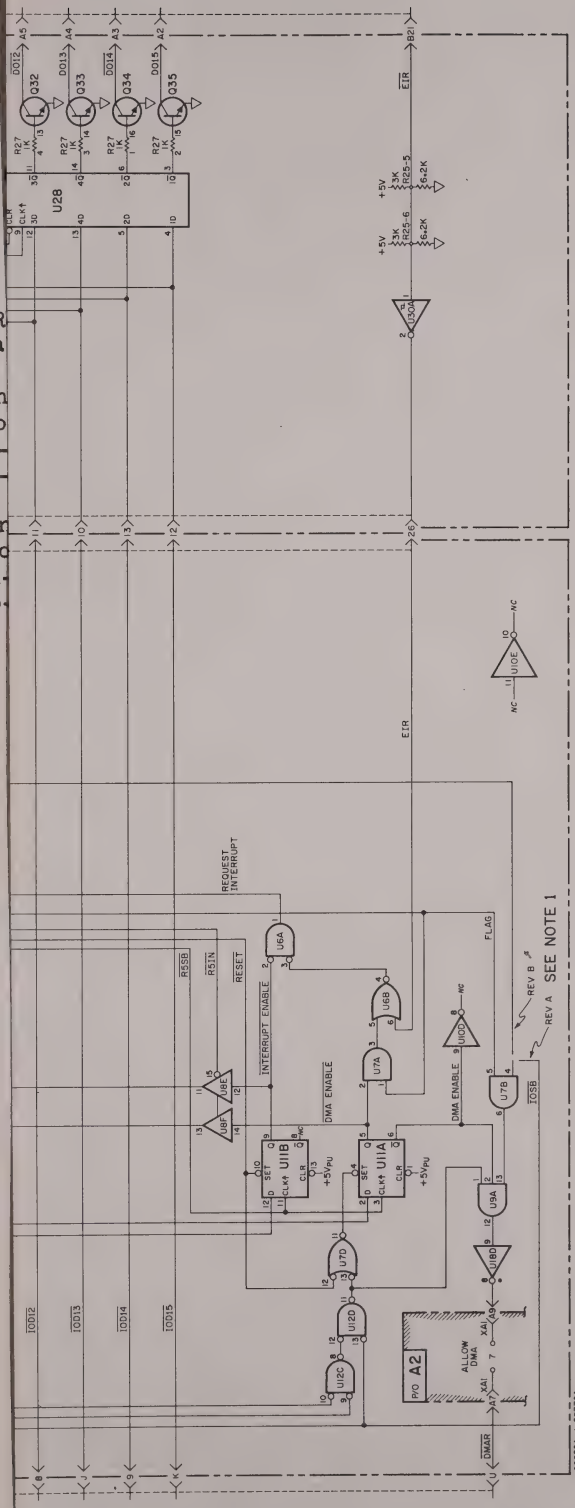
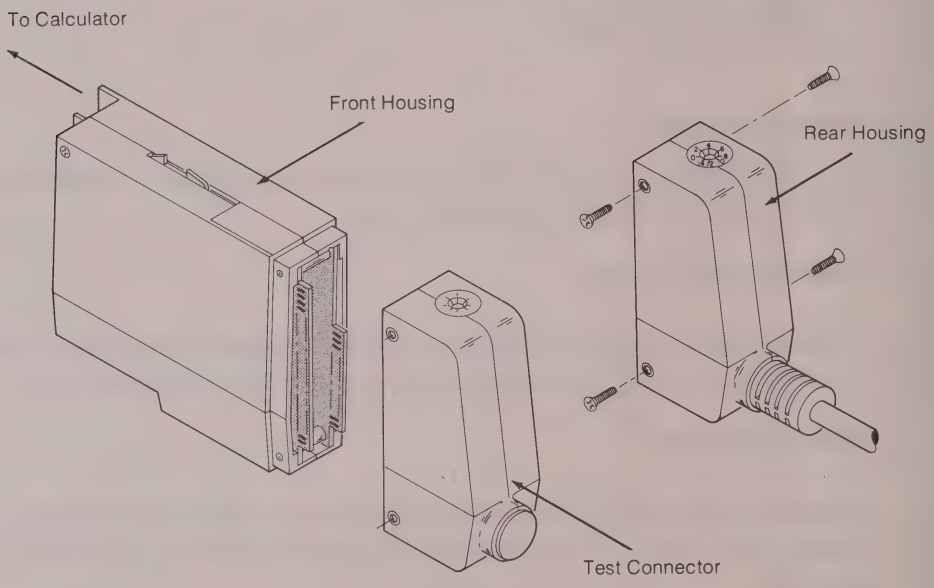


Figure 3-4. 98032A Interface Schematic

Interface Operational Test

The interface can be checked for proper operation by removing the rear housing and installing the optional test connector (P/N 98241-67932) and then running an interface test program. An example test program that can be used with the 9825A Calculator is given in the Appendix.



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If the interface operates properly with the test connector but fails to operate the peripheral, recheck the peripheral and refer to information concerning peripherals installation and operation.

If the interface fails to operate properly with the test connector, refer to the next section of this chapter.

NOTE 1: U7B pin 4 is connected to the IOSB line on revision A boards and to U15B pin 6 on revision B boards.

NOTE 2: A1 Rev. B and C are electrically the same.

NOTE 3: Change the reference designators of A3, R23-3 through R23-10 to R29-3 through R29-10.

NOTE 4: Change the reference designators of A3, R24-3 through R24-10 to R28-3 through R28-10.

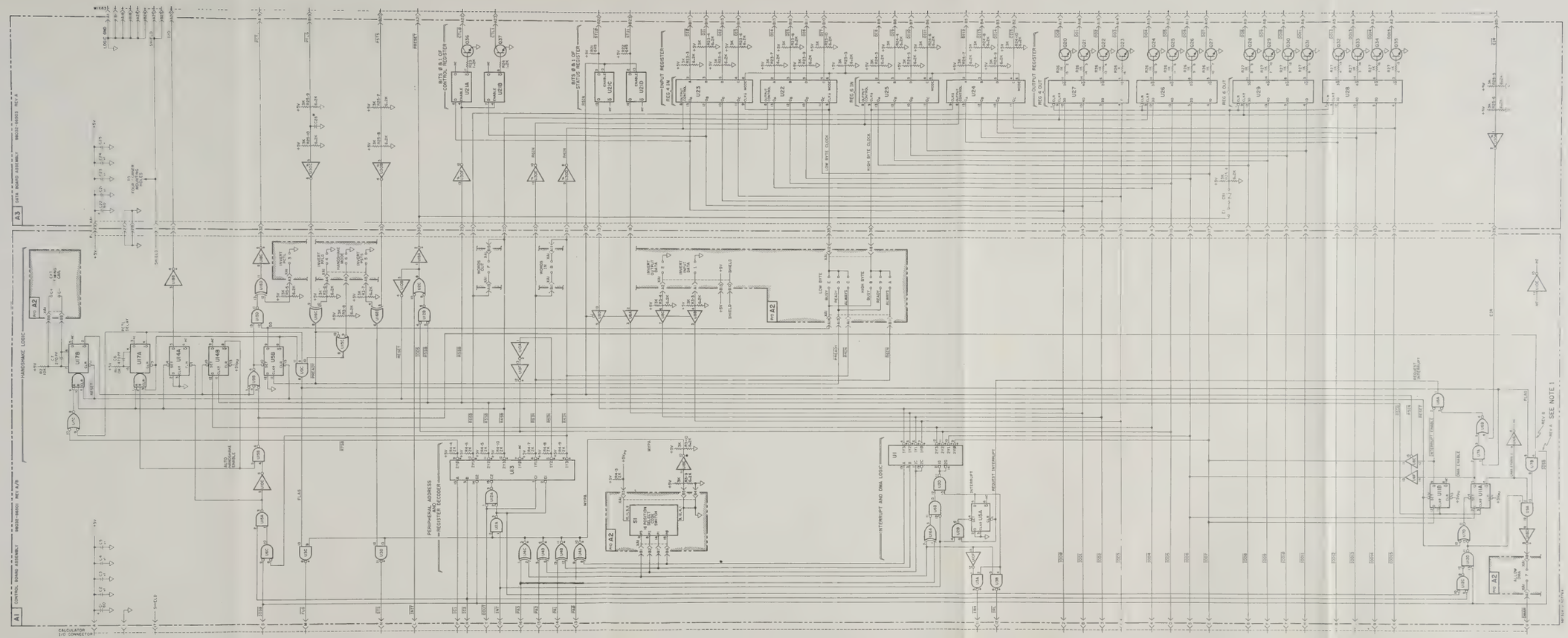

Figure 3-4. 98032A Interface Schematic

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